PUBLIC WORKS.

CITY COUNTY STATE

A COMBINATION OF

"MUNICIPAL JOURNAL & PUBLIC WORKS" and "CONTRACTING"

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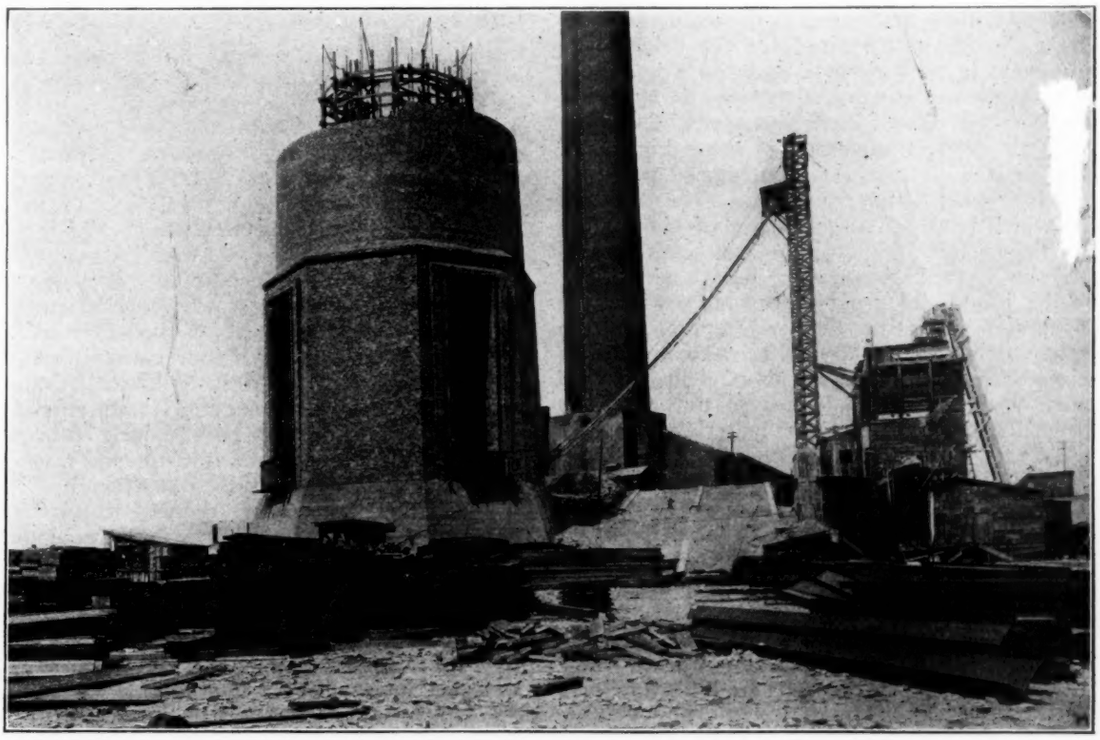
Anaconda Chimney Largest and Tallest in the World

30,000-ton brick structure 585 feet tall and sixty feet inside diameter at top, built with seven interior elevators installed in a full height falsework tower equipped with hand operated pipe derricks. Machine mixed mortar spouted to base of chimney. Methods employed illustrate operations applicable to construction of tall chimneys for waterworks, power plants and other purposes.

In order to precipitate substances previously carried off in smoke and thus reclaim a valuable amount of gold, silver and copper, a smoke treating plant has recently been completed for the Anaconda Copper Mining Co. at their Washoe Smelter at Anaconda, Montana. This system required for its operation a very much stronger draft than was provided by the existing chimney, 300 feet high and 30 feet in diameter at the top. A new chimney, 60 feet 2 inches interior top diameter and 585 feet high above the surface of the ground, has been built 200 feet distant from the old chimney by the Alphons Custodis Chimney Construction Co., of New York.



CONSTRUCTION OF NEW CHIMNEY WITH SEVEN INTERIOR ELEVATORS FOR BRICK AND FOR MORTAR DELIVERED TO BASE BY CONCRETE HOIST AND CHUTE. OLD 30x300-FOOT CHIMNEY ADJACENT.

The structure, which is said to be the largest and tallest of its kind in the world, has an octagonal brick base, 86 feet 7/8 inches in diameter at the top and 68 feet high, seated on a concrete footing, 99½ feet diameter at the base and 20 feet in maximum height and 13 feet in minimum height with the foundations terraced off at different elevations to give horizontal footings. The sub-structure is an octagonal wall 18 feet thick at the base in the deepest part and 8 feet thick at the top.

The superstructure consists of a slightly tapered shaft 86 feet 7/8 inches in diameter at the bottom with wall 64 inches thick at the base and 22¼ inches thick at the top just below the corbelling. The interior diameter diminishes from 86 feet 7/8 inches at the bottom to 60 feet, 2 inches at the top.

The shaft and base together weight about 30,000 tons and contain about 17,000 tons of special perforated radial bricks.

In the foundation there are appriximately 4,700 tons of broken stone, 1,750 cubic yards of sand and 10,350 barrels of cement were used.

RADIAL BRICK MANUFACTURE.

For the construction of this chimney there were required approximately 6,000,000 radial bricks, which were made by the Anaconda Copper Mining Company under the patent and supervision of the Custodis Chimney Construction Company.

Laboratory and practical tests of the Anaconda Co. had demonstrated the fact that the copper tailings, a hitherto waste product, was suitable for brick making, and these bricks were therefore made by the company in their existing brick plant. The tailings, which were of a finely ground pasty consistency, were delivered to the mixing machine and thence to a press from which it emerged through vertical steel dies, that formed the compound to the exact dimensions required for the bricks, delivering same in a continuous mass on a belt conveyor, where it was cut to the required depth by an automatic cutter, then removed, seasoned 24 hours in a hot air drier, transferred to the baking kilns for the desired period, and then stored until required for construction purposes. These radial bricks, which have a maximum size of about 10⅝ x 6¼ inches, have trapezoidal cross-sections perforated by several rectangular holes, which improve the joints and provide air spaces which act as insulation protecting the cold outer air from the warm air within. The bricks are of five different sizes with a minimum length of 4 inches. All of them were made in advance so that no delay was encountered in waiting for materials when the chimney was under construction.

FOUNDATION.

The foundation excavation, about 100 feet across, was carried down by hand owing to the shape of the cut, to a maximum depth of 15 feet on one side and 10 feet on the other side by pick and shovel work. Considerable blasting was necessary to trim off the soft and irregular rock surfaces into several horizontal benches.

After completing the excavation, the forms to receive the concrete mass were built up complete. The outer shell was braced by the backfilling and the inner shell was braced by heavy timbers extending across the entire core at top and bottom.

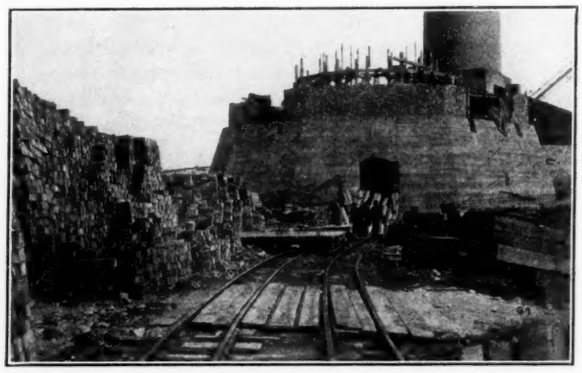
At the commencement of pouring operations, a mixing plant containing three large elevated hopper bottom storage bins, having a capacity of 30 to 40 cubic yards each, were constructed for sand, broken stone and cement. These materials were delivered on standard gauge cars, dumped into track hoppers and elevated by bucket elevator to the bins.

The bins delivered through bottom gates to a central charging hopper, which in turn dumped the proper proportion of aggregate into two one-yard mixers. Finished concrete was delivered to a one-yard bucket in a wooden hoisting tower, 115 feet high, from which it was spouted through steel chutes to the forms in the foundation pit.

Work was continuously prosecuted day and night until the sub-structure, containing about 5,000 yards of concrete, was completed in a solid monolithic mass to the required elevation. This work was accomplished in about eight days.

HOISTING AND SCAFFOLD TOWER.

After the completion of the concrete sub-structure, the irregular bottom of the interior core



SPECIAL BRICK DELIVERED FROM STORAGE ON NARROW GAUGE SERVICE TRACKS.

or well was surfaced with concrete to facilitate the movement of materials to the elevators and prepare a surface for the start of the tower which was laid out in the shape of a seven sided figure.

In the bottom of the well 28 vertical 1-inch steel dowels projecting 12 inches above the concrete surface were set on the centers of 28 posts which formed the tower. The tower consisted of seven independent elevator shafts carried eventually 610 feet high, each built with four corner posts, beginning at the bottom with 10 x 10 inch timbers in 16 foot lengths with staggered joints spliced with four wooden scabs with two 7/8 inch bolts at each end of scab. These elevator towers were about 9 feet square on the inside. At a height of about 100 feet, the timbers were reduced to 8 x 10 inch; at a height of 175 feet, they were reduced to 8 x 8 inch; at a height of 250 feet, they were reduced to 6 x 8 inches; and at 325 feet, they were reduced to 6 x 6 inches.

The towers were braced in themselves and to each other with X bracing and 2 x 8 inch horizontal struts at intervals of 5 feet vertically, that formed belt courses around the exterior and interior of the tower to correspond with the successive stages of the working scafforld. On these struts were placed putlock timbers running to the inside struts

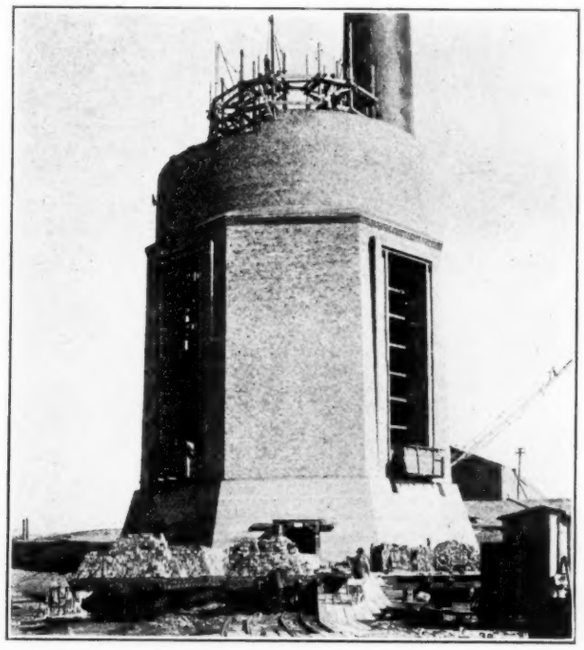
of the tower with a 6 inch bearing on finished brick work. Scaffold planks were laid on these putlock timbers and tacked down. Four by four inch strips were used as elevator guides, spiked to 2 x 8 inch struts.

The towers were built continuously by a regular force of five carpenters, that maintained them at an elevation of about 16 feet above the masons' working platform. The timbers were handled by light pipe derricks with short booms and hand windlasses. Each tower had this type of derrick.

The hoisting was done by three electrically-driven double drum hoists. Each hoist taking care of two elevators. Two of the hoists were driven by 90 h. p. motors. The four elevators connected to these hoists were elevated at a speed of 750 feet per minute. The other two elevators were connected to a 25 h. p. motor which elevated at slow speed and was used for hoisting men and heavy timbers.

DELIVERY OF BRICK AND MORTAR.

After completion of the concrete substructure, the storage bins for aggregate at the mixing plant



SPECIAL BRICKS DELIVERED DIRECT FROM KILN ON STANDARD GAUGE FLAT CARS.

were used for sand, fireclay and cement. This material was mixed in the two mixers and spouted to a 4 yard hopper at the base of the chimney. The material was loaded from this hopper into wheelbarrows, which were themselves sent up on elevators as fast as desired.

Owing to the great volume of bricks that were made in advance of actual operations, it was found to effect an economy in handling to send a large number of the bricks to the site of erection. These bricks were sent up on standard gauge flat cars and piled as near as possible to site of erection. The great volume of bricks on the site, combined with timbering for the tower covered considerable area extending some distance from the chimney.

To overcome this long haul by hand a narrow gauge railway was laid down with several switches leading into a double track into the chimney. Platforms 15 feet long were bolted to two cars. Platform cars were then loaded with eight wheelbarrows of brick and heavy timbers, which were hauled into chimney by a small double drum engine with wire cable operated through a snatch block.

After the brick from outlying areas had been used it was found that this narrow gauge railroad was not economical for short hauls and it was abandoned. Standard gauge flat cars were loaded at the brick yard and brought within 20 feet of chimney, where they were unloaded partly on a platform and partly direct from the cars by hand.

BRICKLAYING.

The bricks were laid at an average rate of about 30,000 per day by a force of bricklayers running from fifteen to thirty men working one 8-hour shift. Usually, the men were located close together around one-half of the circumference of the chimney, building up 5 feet from each scaffold. As the men advanced and completed a portion of the lift the carpenters followed with their putlock timbers and flooring to get ready for the masons.

Notwithstanding considerable delay on account of high winds and the fumes from the other chimneys, the masons beginning with the progress of about 3 feet vertically per day finally attained a maximum speed of 5 feet with an average of perhaps 3½ feet during the process of construction.

The variable batter was accurately secured by use of batter boards, cut to the batter of the chimney, which were held against the outer face of the chimney and to which the bricklayers carefully pushed the bricks. Two men did this work.

The brickwork was commenced May 28th and finished November 11, 1918. After completing it, the interior towers and scaffolds were removed by a stiffleg derrick with 40 foot boom operated by a hoisting engine at the foot of the chimney. This derrick was made fast to one of the tower timbers by an encircling ring, wedged against it, holding it by friction, and enabling it to be easily lowered.

The contract of the Custodis Company was done under the general direction of W. C. Capron, mechanical superintendent of the Anaconda Copper Mining Co., Wm. Rutherford, resident manager.

The method of scaffolding tower was designed and operations were commenced under the personal direction of B. G. Laughton, construction engineer for the Custodis Company.

Slump Test for Road Concrete

A sample of the wet concrete is placed in a 6-inch steel pipe 12 inches long, open at both ends and seated on a horizontal board. The pipe is slowly and steadily raised vertically until it is clear of the concrete, when the latter, being deprived of horizontal support bulges out sideways, allowing the top surface to be depressed, an amount which should not exceed 4 inches for hand tamped concrete. For 60,000 yards of roadwork by the Marquette Construction Co., the engineers, Windes & Marsh, of Winnetka, Ill., used this apparatus, lifting the pipe with a simple portable hand windlass and found the slump rarely exceeded 2 inches.

Studying Manufacturing Wastes in Connecticut

Studies made in Connecticut on reducing pollution from plants engaged in manufacturing with metals, including recovery of metal from the waste, and prevention of nuisance. The view of the Connecticut State Board of Health concerning disposal by dilution is given.

About two years ago, following several years of agitation for reducing the pollution of the streams of Connecticut by manufacuring wastes, there was constituted a State Industrial Waste Board, composed of the State Department of Health, two manufacturers, two engineers and on representative from the State, at large, to study the problems involved and report to the next sesstion of the legislature. Most of the manufacturers co-operated heartily with this board, a number of them supplying means for carrying out in their works practical experiments necessary for the successful development of methods for recovering valuable by-products. In a general symposium on stream pollution before the Connecticut Society of Engineers, information was given concerning the progress made in this study.

RECOVERY OF METALS.

Both electrolytic and chemical methods were tested. In one plant, by electroplating, the copper content of the liquid was reduced from an average of 15 grams to 4 grams per liter, and zinc from 25 grams to 5 grams, with an equivalent recovery of sulphuric acid. On depositing the copper, the solution was neutralized with zinc oxide from flue dust, and the remaining copper and any cadmium were cemented out with scrap zinc. The small amounts of iron, arsenic and antimony present were removed by means of manganese dioxide and powdered limestone. The zinc was then deposited electrolytically from the pure sulphate solution. Careful cost estimates indicated that copper, zinc and sulphric acid could be recovered profitably from wastes, even on the basis of pre-war prices. It was evident, however, that this process would be profitable only in large plants where a cheap supply of zinc oxide from flue dust was available, and where there were a number of pickle tanks.

For other conditions, straight chemical processes are being studied, which include the recovery of copper by cementing it out of the liquor with scrap zinc, followed by evaporation of the purified wastes to produce zinc sulphate. The equipment for this process is much less extensive than for electrolytic treatment, thus making it applicable to small plants.

For treating wash water, a process is being tested which consists of neutralizing the free acid and precipitating copper and zinc with lime, the treated wash water being recirculated through the manufacturing plant, because of objections by manufacturers below to its discharge into the stream. So far no recovery of metals from the sludge has been secured and disposing of the sludge offers a serious problem.

While the board has not yet carried its studies to completion, James A. Newlands, who made the investigation for the board, believes that he is warranted in stating that metals can be recovered profitably from the wastes under consideration, but the proportion of metals and acids kept out of the streams by the processes is not sufficient to warrant their adoption on the basis of stream improvement; and that it is desirable, therefore, to continue the study of the problem with a view to developing such improvement.

THE HEALTH VIEWPOINT.

Considering the subject from the point of view of health, J. Frederick Jackson, director of the Bureau of Sanitary Engineering of the State Department of Health, in his contribution to the same symposium, emphasized the necessity for investigation of the *manufacturing* waste problem. While much yet remains to be learned concerning the final treatment of *domestic* wastes, yet the lines for future investigations are fairly well defined, and most of the recognized processes are quite well understood. But scarcely a beginning has been made in the treatment of industrial wastes. Such investigation is in a preliminary stage, and has been limited to a considerable extent to the laboratory, and has not been tried out on a commercial scale to a sufficient degree to permit the drawing of definite conclusions of general applicability.

It is only of comparatively recent years that stream pollution by trade wastes has become sufficiently intense to direct public attention to the necessity of preventing or minimizing it. It is, however, evident that immediate action is demanded in the case of many streams. Mr. Jackson believes that periodic examination of streams is desirable, so as to discover and correct conditions which, if permitted to persist without attention, will become so grave that they cannot be corrected without radical procedure and stringent legislation.

In making this investigation of the stream, the Health Board laid out the following program:

Location and establishment of gauging stations; cross sections of river bottom at each station; gauging stream flow; measurements of discharge from present sewer outfalls; census of industries on watershed and character and amount of their industrial waste; amount of water diverted from river for use in process of manufacturing. Analysis of water at different stations for dissolved oxygen, alkalinity and acidity, and bacteriological examination for the presence of colon; census of present population contributing sewage and estimate of future increase to compare with stream flow neces-

sary to afford sufficient dilution to avoid nuisances; a study of the economic gain to industries using river water in process of manufacture by decreasing the alkalinity or acidity. The feasibility of establishing storage reservoirs on tributaries of the river sufficient to provide increased stream flow necessary for proper dilution. The feasibility of methods of treatment for reclaiming the wastes from the present processes of manufacture and using them as the raw material in the production of by-products, the sale of which would at least offset the cost of treatment.

Work under these different heads has been proceeding since the latter part of May, 1918.

Some of the problems affecting the study are the great complexity of the chemicals used by the different plants, with variations in quantities and character from hour to hour and day to day; the effect of the presence of copper upon bacteriological analysis and its action as a germicide; the effect of the daily variation in the flow of the stream; the influence of pondage in decreasing the pollution below dams and intensifying it through the accumulation of sludge above the dams; the effect of rapid and sluggish flow of streams, respectively; the amount of regulation on the stream by ponds and dams, etc.

"The solution would seem to be in partial treatment of both domestic and industrial wastes at their source, supplemented by such increased dilution as can be obtained from storage at reasonable cost."

MAKING ANALYSES OF RIVER WATER.

Discussing the chemical and bacteriological side of the investigation, Floyd W. Mohlman, chief chemist of the Chicago Sanitary Bureau, in the symposium above referred to described the general method of making chemical and bacterial analysis as follows:

"We have measured the concentration of pollution by determinations of dissolved oxygen, dissolved oxygen consumed in 48 hours at 20° C., ammonia nitrogen, total organic nitrogen, chlorine, alkalinity, total solids, suspended solids total bacteria at 20° C. and B. coli at 37½° C. The determinations of ammonia and organic nitrogen indicate the comparative concentration of organic matter in the water but do not necessarily indicate the liability of nuisance in the river at the place from which the sample was taken. The results of investigations of stream pollution made in the past have indicated that the concentration of dissolved oxygen and its rate of dissappearance when the water is incubated are correlated more closely with actual production of nuisance than are determinations of nitrogen, total solids or oxygen consumed from permanganate. It is well known that foul odors will be produced when there is no dissolved oxygen present in the water, as the anaerobic, odor-producing bacteria multiply under these conditions. There is a great difference of opinion among experts as to the amount of oxygen necessary to prevent odors in river waters, but it is usually assumed that no odors will be produced if there is over 40% of dissolved oxygen in the water. A larger amount is usually considered necessary in order to support major fish life, although some sanitary engineers claim that only a few per cent of saturation of dissolved oxygen will suffice. We have been rather surprised to find that of all tests for dissolved oxygen made on the Naugatuck River, the lowest average monthly per cent of saturation was 37%, below Torrington in August. Below Waterbury the lowest was 51% in August. The reason for this unexpectedly large amount of oxygen at places shown to be highly polluted by other tests, is due to riffles in the stream, which introduce a temporarily large amount of atmospheric oxygen into the water. We have found that in a stream such as the Naugatuck, with its swift flow, the determination of dissolved oxygen in the field did not indicate the amount of contamination in a given sample or its possibility of nuisance. We have found that the consumption of dissolved oxygen in forty-eight hours at 20° C. was a very fair relative test of pollution, as in such a procedure the actual condition of the sample is shown with regard to its liability toward putrefaction, and transitory effects of aeration are eleminated. We have found that 95% of the dissolved oxygen was frequently consumed in forty-eight hours in samples from the more polluted places during the summer months, while only 20% was consumed during the winter months in samples from these same stations.

PREVENTING NUISANCE.

The board is attempting to calculate the stream flow necessary at critical points in order to prevent nuisance, but finds it a different procedure because, first, there is such a difference of opinion among sanitary engineers as to the proper standard above which nuisance will occur, and, second, no entirely satisfactory method of computation is known by which it may be determined how much a sample with a given dissolved oxygen consumption must be diluted in order to bring the consumption down to the value set as a standard. The board is working on these problems, and is convinced that the necessary dilution can be calculated best from the results of this determination of dissolved oxygen consumption, rather than on the basis of so many second-feet per thousand population contributing sewage, or from the determination of nitrogen or chlorine. He agrees with the British Royal Sewage Commission that a clean water should not take up more than 2.0 parts per million of dissolved oxygen in five days at 18.3° C., and that a water which takes up 4.0 parts in five days is not fit for use as a diluting water, and is on the verge of becoming a nuisance itself.

A great deal of nuisance comes from deposits of suspended matter on sand bars and the bottoms of mill ponds. Many of the latter act as sceptic tanks. Mud from the bottom of one pond had a dissolved oxygen demand of about 8,000 parts per million, or 20 to 80 times as much as raw sewage. Incidentally, it was found that this mud contained 17.8 pounds of copper per ton of dry mud, worth $4.63 under war prices.

Referring to the popular impression that acids in rivers practically sterilize them, Mr. Mohlman said that they had found as many as 6,300,000 bacteria per c. c. in the river water, and that the average of every station in the Naugatuck river from Waterbury to the mouth, in July, was well above 1,000,000 per c. c.

B. coli are destroyed by copper wastes, however, and probably any pathogenic organisms associated with them, only from 3 to 72 B. coli per c. c. having

been found in the samples. It is probable that the B. coli are killed off very quickly, after which the copper is precipitated, and the saprophitic forms multiply very rapidly. This phenomenon is similar to the great increase in bacteria in reservoirs following treatment with copper sulphate as an algicide, or to the after growths found in water supplies that have been treated with chlorine.

Acid wastes delay the normal processes of stream purification until the copper has been precipitated, and they thus serve to carry unoxidized organic matter farther down stream than would be the case if they were absent.

DISPOSAL BY DILUTION.

The board believes that the policy of using a river to its maximum capacity as a purifier of trade wastes and sewages, without at the same time causing nuisance, is more rational than one which demands that all wastes and sewages be treated to such a degree that they will not affect the condition of the stream in any way. The streams can never be restored to their original state of purity and in the lower reaches of populous districts will probably never be used as sources of water supply. It is believed, however, that they should be cleaned up to such an extent that they will not be noticeably obnoxious and odorous during the summer months.

Terrific Flames Extinguished by Dynamite

On July 26, 1919, while one of the Standard Oil Company's wells near Taft, California, was producing 180,000,000 cubic feet of gas under enormous pressure every 24 hours the friction of sand on 8,135 feet of 10-inch casing pipes heated the latter red hot and ignited the gas before the casing could be valved and the flow controlled.

The enormous flames, 50 feet wide and 300 feet high, commenced at a point 12 feet above the top of the casing and produced such an intense heat as to melt metal at the casing and make it quite hot for a radius of 50 feet. The roar of the gas could be heard ten miles and the flames could be seen 80 miles. Shouting could not be heard within a distance of 1,000 feet from the well, near which it was, of course, impossible to work.

For nine days and nights strenuous efforts were made to extinguish the flames, and at the fourth attempt 20 steam boilers and 11 rotary pumps threw twenty-one 3-inch and nine 4-inch lines of steam, water, mud and carbon tetrachloride on the flames without avail. Artillery officers of the U. S. Army declared the flames too great to be extinguished by bombarding with field artillery, and after the expenditure of nearly $500,000 all efforts to extinguish the flames had been in vain.

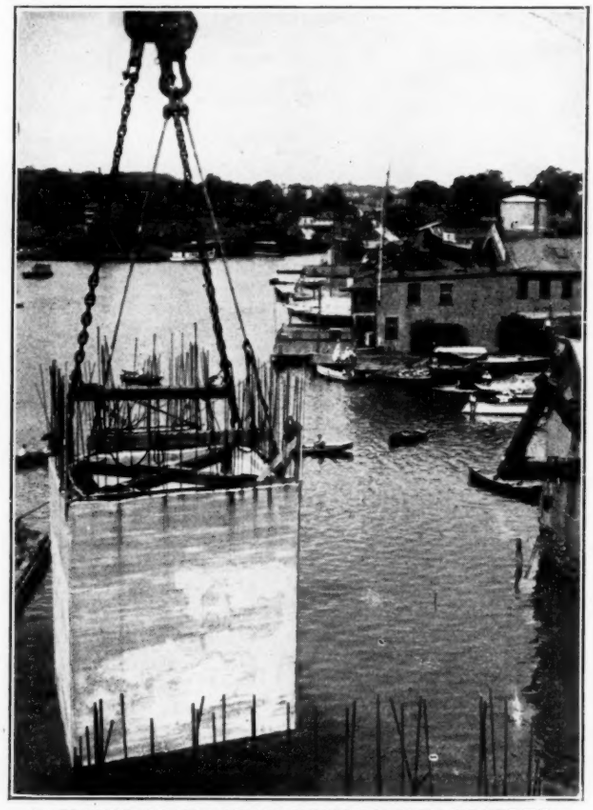
On the tenth day an attempt was made by Ford Alexander, expert oil well blaster, to extinguish the flames by explosives. A 40-foot derrick was installed on each side of the well, beyond the radius of extreme heat, and a 9/16-inch steel cable was passed through sheaves on their tops and laid on the ground between them outside the super-heated zone.

About 150 pounds of Giant blasting gelatine, heavily wrapped in asbestos, was attached to the cable, and the latter, being operated by a hoisting engine at one end, rapidly lifted the explosive from the ground and hauled it to a position over the well, where it was quickly exploded by electricity, the operations being controlled by Mr. Alexander, who had approached within 200 feet of the well under protection of a steel screen cooled by a 3-inch hose stream.

The explosion divided the huge torch of flames into three distinct portions, one of which was displaced horizontally and the other vertically until they died away; while the third, or lower portion, was snuffed out like a candle.

Derrick Sets 150-Ton Concrete Box in Water 25 Feet Deep

Two precast boxes of reinforced concrete form the well-like structure that houses the three centrifugal pumps used to handle the condensing water in



BOX SUSPENDED FROM BOOM BY TWO BRIDLES.

the generating plant of the Stamford, Conn., Gas & Electric Company on Long Island Sound. These pumps are located at the bottom of this 25-foot well structure in water 12 feet deep at low tide, with a range in tide of 13 feet. The boxes, each 30 by 21 feet in plan, were cast on shore, then handled by a heavy wrecking derrick, which lowered them in place onto a foundation that divers had leveled and made ready. The walls are 12 inches thick, the bottom 18 inches, and there is an inner cross-wall 14 inches thick separating the screen chamber from the pump well proper.

Jersey City Coal Pier 1,100,000 Yd. Hydraulic Fill

Slip 30 feet deep and large high fill made by 22-inch suction dredge. Mud, sand and stones moved as much as one mile horizontally, elevated to a maximum height of 53 feet and deposited behind successive tiers of 5-foot earth levees at an average rate of 150,000 yards per month, and at a cost of about 30 cents per yard.

The construction on the shore of the Hudson River at Jersey City of a coal storage pier, No. 18, with capacity for handling 400 cars in 8 hours for the New Jersey Central Railroad, involved the improvement of the slip and channel by dredging to a depth of 30 feet below mean low water and grading part of the land at the shore end of the pier originally from nothing to 8 feet above water level, up to an elevation of 23 feet. This involved dredging about 1,100,000 yards of earth and sand which was accomplished by one 22-inch hydraulic dredge in about 8 months for a price of about $320,000.

The pier was designed and constructed under the direction of the Engineering Department of the Central R. R. of N. J., A. E. Owen, Chief Engineer. The Atlantic, Gulf & Pacific Co., New York, was the contractor for the dredging and hydraulic fill which was commenced June 1918 and completed in February 1919 at a contract price of 29 cents per cubic yard, place measurement in the cut.

GENERAL CONDITIONS.

The building of the pier included extensive improvements on the property owned by the railroad company between its existing piers on the water front where the land in-shore of the Government bulkhead line was partly submerged and partly had an irregular surface slightly elevated above mean high water. It was desired to excavate some of the submerged land so as to increase the depth of water from about 6 feet to 30 feet at low tide, making a slip for large vessels in an area about 400 feet wide and 3,000 feet long and to build up the adjacent area about 400 feet wide and 3,500 feet long to a minimum elevation of 5 feet above high tide, sloping up to a maximum elevation of about 23 feet above high tide so as to provide for the storage, shifting and classification yards having a capacity for a large number of coal cars, and form a ramp or hump on which the dumping machines are located to provide for returning the empty cars to the storage yards by gravity.

At this place the bottom of the river consisted of mud, sand and hard gravel approximately equivalent to hardpan, overlaid with a stratum of soft mud 5 or 10 feet thick. Below the mud loose stones of moderate size were found, but there were no sunken wrecks or other serious obstruction encountered. About 275,000 yards of sand dredged from the piers of the Brooklyn Army Base by dipper and bucket machines were transported to the Jersey City Pier site, dumped in water from 15 to 30 feet deep in front of the dredge, and by it pumped up and delivered on the pier site, for additional fill.

DREDGE AND PIPE LINE.

All of the fill was handled by the contractor's 22-inch hydraulic dredge "Clinton" which worked from in-shore out, depositing the fill from out-shore in. From the dredge to the edge of the pier the pump discharged through a 22-inch floating pipe line about 1,000 feet long with ball and socket joints supported on steel pontoons. This pipe was supported beyond the pier line on about 2,200 feet of pile trestle, provided by the railroad company, parallel to the center line of the pier.

At the in-shore end of this trestle a discharge pipe was provided with a valved Y, each branch of which was extended as necessary beyond the valve, one of them being in service while the other was cut off and the pipe extended or shifted as required. In this way the water and solid materials were distributed over the pier.

As it became necessary, and during the time when the dredge itself was undergoing repairs, the Y-valves were moved further out in the fill in order to reduce the number of pipe necessary in handling the job by increasing the length of the single line and reducing the length of the two branch lines.

The land pipe was made of 3/16-inch riveted steel plates in sections 16 feet 6 inches long and was connected by telescopic joints with an overlap of about 6 inches. Joints were quickly made and broken by three or more men with bars, and were sometimes secured by lashings around lugs riveted to the ends of the pipe sections. These lashings, however, were frequently omitted. The total length of the discharge pipe varied with the position of the dredge and the advance of the fill, and attained a maximum of about one mile. The water and solid material were pumped to a maximum elevation of 23 feet and from a maximum depth of 30 feet at mean low water.

LEVEES.

The fill being deposited from the discharge pipe in a fluid condition in shallow water and on low flat ground was retained by earth levees started in advance of the pumping and continued and maintained as the fill progressed. Two levees about 4,000 feet long were built on opposite sides of the pier area, approximately perpendicular to the bulkhead line and were connected at the river end by

a transverse levee about 400 feet long. The levees were built by shovel gangs, the material being obtained from two parallel ditches 5 feet wide, 3 feet deep, and 20 feet apart in the clear for each levee.

In order to reduce the amount of levee work the original levees were built only about 5 feet high, and after the fill had reached approximately this elevation additional levees were constructed on top of the fill. The two levees thus constructed having considerably less yardage per foot than would have been necessary if the original levee had been constructed to the final height.

When the flow from the dredge discharge pipe approached the top of the levee or threatened to wash it away, the levees were protected by splash boards in sections 12 feet long, each panel of which was made from three or four 1 x 10-inch horizontal planks nailed to transverse cleats projecting beyond one edge to form stakes which were set in the ground to maintain the boards in vertical positions. Men working behind these boards built up the top of the levee to the required elevation.

EFFLUENT AND SEDIMENT.

The discharge pipe was so handled as to distribute the material over the surface of the fill at an approximately uniform grade of about 1 per cent, bringing the summit at about the required location for the top of the specified hump. After this fill was made, it was necessary to cut through it for the location of a low grade railroad track, and the excavation was made by a steam shovel which removed enough material (about 100,000 yards) to build up the summit of the hydraulic fill to the required elevation for the top of the hump.

After depositing the dredged material between the levees, the effluent water from the discharge pipe flowed through a sluice-way 20 feet wide, 2 feet deep and 500 or 600 feet long that was cut at the shore end of the fill site and discharged into an unimproved tract about 4,000 feet long that belonged to the railroad company and was enclosed at the river end by a dam with a sluice-way in it, thus providing for the settlement of any matter that had remained suspended in the water and not only prevented its return to the dredge basin but to a substantial degree filled up the low land behind the dam.

During the time that the levee was under construction the maximum force of the dredge contractor was about 160 men, which was much reduced when there was no levee building. The dredge was equipped with a steel ladder and a six-blade cast steel cutter so that hard material could be handled and stones with their greatest dimensions only slightly less than the diameter of the discharge pipe were often pumped under the fill. The maximum rate of dredging was about 150,000 yards per month.

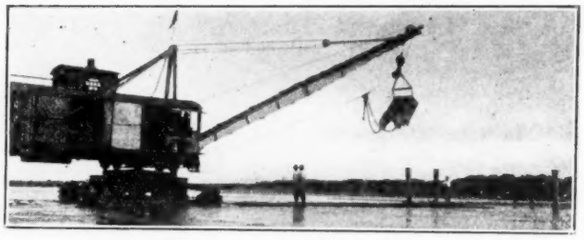
The public service commission, New York, has ordered the Long Island Rail Company to construct a new bridge over Flushing river at Flushing and to submit plans for the same to the commission within sixty days.

75-ton Excavator Crosses the Rio Grande

The Rio Grande River has such a treacherous bed that it is a very easy matter for any heavy object to find quicksand and slip down into it. That is why much credit is due to the engineers of the U. S. Reclamation Service for their skill in taking across the river without mishap a dragline excavator weighing 150,000 pounds. It was necessary to move the outfit from the west to the east side of the river at Mesquite.

This No. 9 execavator, which is similar to seven others on the Rio Grande project, is a dragline with a 1½ yard bucket, and is equipped with a 125 horse-power marine engine weighing 7 tons and a caterpillar tractor.

The excavator was taken from one bank to another, a distance of nearly 1,000 feet, in 6 hours 30 minutes. The transfer was made over a continuous timber platform, securely guyed.



EXCAVATOR EMERGING FROM DEEP WATER.

The operation was under the direct supervision of N. E. Fordham, master mechanic of the Rio Grande project, who has been recommended by officials of the service for his good work.

Change of Name

How It Strikes Our Friends.

"I see by your cover you've changed your name,
But the good you've been doing, remains the same.
Each issue contains interesting news,
What is being done, how you can choose
The best method, the best course to pursue
When problems arise, the best thing to do—
In emergency cases, complicated, or bad,
Your various departments, are only too glad
To help your readers, or managers out
In the East, the West, the North, or South.
By professional advice from competent men,
Employed by you, to help now and then
The different communities, when troubles arise.
You are always willing and glad to advise,
Where, when, and how, you can buy
The necessary articles, if your advs. they try
To remedy their troubles wherever it lurks
Can be purchased through the PUBLIC WORKS."

—*P. J. Egan.*

The city of Davenport established a new record in 1919 for laying 10½ miles of pavement, nearly all of it having a 2-inch top of asphaltic concrete on a 5-inch concrete base, the whole weighing 59 pounds and cost $3 per square yard.

PUBLIC WORKS.

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A. PRESCOTT FOLWELL, *Editor*
FRANK W. SKINNER, *Associate Editor*

Use More Labor-Saving Equipment

The world-wide pestilence of extravagance, idleness and disaffection, aggravating the frightful war destruction of life, property and organization, are leading to revolutions in utility, municipal, industrial and construction matters as well as in social, financial and political directions. Eventually an adjustment will inevitably be made on the bed rock basis of supply and demand but meantime the socialistic or Bolshevik mania persists and increases, and is rapidly consuming the reserves and safeguards of all kinds of production and progress; inflation continues, and the decreasing value of capital and the unwillingness of labor and of many producers and middlemen to give fair equivalents make new methods and principles necessary.

The scarcity, poor quality, disaffection and complete unreliability of a large percentage of labor renders it a most difficult factor to be reckoned with and necessitates its education, classification, conservation, and that it be held legally and financially responsible for the performance of its contracts and made to obey the statutes of the country from which all class legislation should be eliminated.

But these measures alone will not suffice. The loss of ten million lives, and the destruction of billions of dollars' worth of property within the last six years has set the world so far back and has created such a deficiency of man power, that there will long remain a scarcity of labor, particularly in this country which has depended to so large an extent on immigration, that it will be absolutely necessary to substitute to the largest extent mechanical devices for man power. Wherever, therefore, mechanical equipment can be substituted for hand labor in public operations and the maintenance of utilities, as for instance in handling materials, stoking boilers, sweeping streets, and all other routine operations; where it can be employed in construction work, as in excavating, concrete mixing, paving, surfacing, etc.; or where small tools can be operated by power instead of by hand, and for numerous other services, machinery and power plants should be installed.

The wide distribution of electric power from central stations enables a large amount of machinery to be advantageously driven by it even when there is an apparent disadvantage in unit cost, because of the greater convenience and less waste incurred. Because of cheaper production and transmission and improved appliances, electricity is rapidly being adapted to heavy machinery, including the operation of steam shovels. Where it is not available, improved oil, gasoline and gas motors are often very convenient and for groups of machines or tools compressed air is frequently economical, while steam can be generated at any point where coal or wood is available and in remote or mountainous localities it is often possible to install hydro-electric equipment or hydraulic power to great advantage even for temporary operations.

Power plant and machine tools should be selected not only with a view to their efficiency, but to their adaptability for various operations, for their ultimate salvage and rental value, for the economy of maintenance and with consideration of the class of operators required for them and for auxiliary service.

It should also be remembered that the plant and machines never go on strike; never demand higher wages: with good treatment will work day and night and Sundays almost continuously; can be depended on in an emergency; and when working from twelve to twenty-four hours per day greatly decrease fixed and overhead charges and many risks. Besides this, the direct cost of the work they perform consists only of interest, depreciation, repairs, transportation and attendance, the sum of which is often many times less than the sum of the wages of an equivalent force of hand laborers. Efficient power plant constantly used is therefore a most valuable investment and insurance policy.

Retaining Percentage of Construction Funds Unnecessary

Since 1850 it is said that periods of business depression and unemployment in this country are recurrent at intervals of about 10 years, but this is only comparative unemployment: there is seldom a serious excess of good labor in this country taken as a whole. As the present normal expenditure for public works construction is estimated at about $1,000,000,000 per year, it has been suggested that nine-tenths of this sum be expended in each current year and that the remaining tenth be deposited in a sinking fund held in reserve to maintain construction activity in the periodical dull time.

Such a policy might be good if necessary and if this country were impoverished or had limited resources, but with the enormous wealth, and its gold reserve that exceeds 50 per cent. of that in the entire world, it seems harly necessary unless it might act as a good example for economy that is certainly needed to curb the inordinate extravagances that have overwhelmed almost all recent public enterprises.

What we do want is to have the hundreds of millions of dollars already available, spent promptly and judiciously and to secure full value for every dollar paid out of the public treasury. These results combined with a universal scale of proportionate equality of wages and salaries corresponding to the actual efficiency of the employed would go far almost towards difficult industrial problems.

The Fruits of Unfair Municipal Treatment

Several authoritative statements published in this issue regarding the operation of transit facilities in Greater New York and vicinity illuminate the general subject of treatment of public utilities by the municipality. After reporting that the Interborough Rapid Transit Co. operates the subway to its maximum capacity during rush hours, Public Service Commissioner Lewis Nixon directs them to increase the non-rush hour service by the addition of 600 cars, which is apparently the principal improvement that he finds it practical to make immediately in the transportation of the millions of passengers that have increasingly overburdened the transit lines since their construction.

This action may be considered as refuting in great measure the charges of gross and wilful inefficiency, the hurling of which at the subway and surface lines has been a favorite indoor sport for politicians and soreheads. The fact is that the New York transit system, while safely and rapidly handling an unprecedented volume of traffic, has so much stimulated the growth of the city that congestion has increased more rapidly than relief could be provided for it, so that in reality the more subways, the less comfort to the travelers, and the system has not yet seen much indication of catching up with the rapidly increasing requirements.

In the midst of this difficult condition, expenses have been so vastly increased that the companies have pleaded for increased fares, which have been granted in so many parts of the country, but which have been arrogantly refused consideration here. Mr. Nixon further reports concerning this, that the Interborough, as a system, cannot avoid a receivership without relief, and that it is doubtful if the Brooklyn Rapid Transit can operate at a 5 cent fare without defaulting on interest, to say nothing of making a profit.

Furthermore, the president of trolley lines in the same district offers them as a free gift to the city, provided the latter will operate them at a 5 cent fare, opportunity which the politicians, greedy for graft and patronage, may be expected to look longingly at without being much disturbed by the heavy additional expenses that would cause a deficit which would merely add a heavy burden to the taxpayers. Where both the expenses and the revenue of any business concern are arbitrarily controlled by influence which they cannot govern, such a result is sooner or later inevitable for any public utility.

The Gentle Art of Highwaymanship

Labor profiteering is now a more or less profitable example of the gentle art of highwaymanship than it was during the war emergency. According to statistics of the Hoboken Ship & Repair Yard of the New York and New Jersey Dry Dock Association, published in the Journal of Commerce, more than 60 per cent. of the pay received by a force of over 3,000 men was for overtime. In ten out of eleven different classes, the men drew more pay for overtime than for straight time. The classes included carpenters, caulkers, deckhands, engineers, painters, machinists, electricians, blacksmiths, pipefitters, iron workers and riggers. The percentage of overtime varied from 50.02 for the caulkers to 68.04 for pipe-fitters.

The figures were all taken on the present basis, and the job which cost about $377,000, would only have cost $332,000 had it all been done on straight time.

In 1914 the average weekly pay of the machinist was, for straight time $19.68, for overtime $9.43. At present it is for straight time $41.47, for overtime $40.26, making $91.73 per week equal to a raise of 180 per cent. since 1914 while the helpers have received a raise of 274 per cent. As the high cost of living is estimated to have advanced 110 per cent. since the beginning of the war, the machinist's pay has risen 70 per cent. above the cost of living and the helpers have risen 164 per cent. above the cost of living. Notwithstanding these facts, the men are claiming a farther advance of 25 per cent. pay, a larger quantity of overtime which if granted would raise the average machinist's pay to $102.14 per week.

With these facts must be considered the decreased efficiency and the shorter working hours that delay the work at an enormously increased risk and overhead and it is easy to see to what conditions autocratic interference, initiated by the pernicious Adamson bill, and succeeding granting of confiscatory wages to turbulent labor, has subjected all business interests, and how it injures every class in the nation except the organized laborers who have thus been criminally subsidized for contemptible political motives.

Specifics for Labor Troubles

When this country has suffered enough from restricted production, inflated prices, insecurity of capital, destruction of industrial and construction interests and the general ravages of labor tyranny and robbery; when the surplus and reserve funds, the fruits of energy, economy and enterprise have been sufficiently dissipated, and perhaps not until the whole country has been plunged in terrific misery, will we see and acknowledge the two great remedies for the strike leprosy.

These are, first, the compulsory incorporation of all labor unions and organizations with restrictions compelling them to maintain resources available for fines and penalties so that they will be held to their solemn covenants equally with the employer participants and, second, when in every case, the existing laws throughout the country are universally enforced without fear or favor, to prevent and punish all kinds of violence, conspiracy and intimidation, whether by individuals or organizations. No classes will then be exempt from the actions of these laws as is now notably the case while farmers and labor unions are specifically excepted from important laws that, in their partial administration are a weapon of political schemers and a terrible menace to the safety and prosperity of the nation.

In 1919, the state of New Hampshire, commenced construction of 72 new highway projects involving 92 miles of road and, it is expected will expend $1,250,000 on the construction of 110 miles of new highway, much of which will be finished in 1920.

Kenova Viaduct Erection

Single Track Girder Structure Under Heavy Traffic Replaced by Double Track Structure on Same Foundation. Sets of Three 31- and 61-Foot Spans Were Successively Supported by Overhead Traveler While New Centre Viaduct Towers Were Built Under Them and Girders Afterwards Replaced Without Interrupting Train Service.

The replacement of a railroad girder viaduct by a new structure in the same position has always been considered a very difficult problem when it was required to solve it without interrupting traffic over the old structure. About the only way to accomplish it, when it is inadmissible to by-pass the traffic, is either to build falsework to support these tracks or to adopt some means of displacing sections of the old original structure and immediately replacing them by completed sections of the new structure that can be connected up and put in service between trains, or by taking out the members of the old structure piecemeal and replacing them by new members, an operation, which, while simple enough for the longitudinal girders, is obviously much more difficult for the transverse girders and tower members.

All of the difficulties were satisfactorily overcome in the reconstruction of the approach viaduct of the Norfolk & Western Railway at the West Virginia end of its bridge across the Ohio river at Kenova, West Virginia. The old single track structure, about 2,148 feet long, consisted of sixty 30-foot 8¼-inch spans and one 61-foot 4½-inch span supported on 30-foot steel towers from 20 to 50 feet high, and at the time of reconstruction carried a traffic of about 72 50- to 75-car coal trains daily.

The old single track structure was replaced on practically the same alignment, but at a somewhat higher elevation by a double-track plate girder structure with spans of the same lengths calculated to support a much heavier load. Successive sets of three of the old spans were temporarily supported by an overhead traveler while the old tower under the centre span was removed and new transverse beams inserted in its place, after which the new towers were completed while traffic still passed over the old girders that were later removed between trains, simultaneous with the erection of new girders and the shifting of the tracks to them so that the train service was practically uninterrupted during reconstruction.

FALSEWORK, DERRICK AND TRANSFER.

Operations were commenced by jacking up the old viaduct until the track was at the required new grade and supporting the tower columns on wooden blocking on the concrete pedestals that later received the columns for the new viaduct. A derrick was installed on the pier at the north end of the viaduct, erected falsework in the two adjacent panels of the viaduct and on it assembled the first two spans of the new double-track structure which consisted of four-column towers each with two traverse girders carrying the four lines of longitudinal girders.

The derrick also erected on the first two spans of the new structure a wooden tower traveler with one 80-foot and one 65-foot 12-ton steel derrick booms operated by a hoisting engine on a working platform elevated 21½ feet above the rails and giving clearance under it for train service on the old track. The derrick advanced on rails laid over the outside girders of the new structure. Material for the new viaduct was delivered on a service track laid on the ground parallel and adjacent to the old viaduct.

ERECTING AND REPLACING TOWER.

The columns, girders and cross-bracing for the two tranverse bents of the second new tower were erected in vertical position on blocking, level with the tops of the concrete pedestals and were temporarily braced in position while the transverse bents of the first old tower were also braced to support them while the longitudinal bracing of the tower was removed.

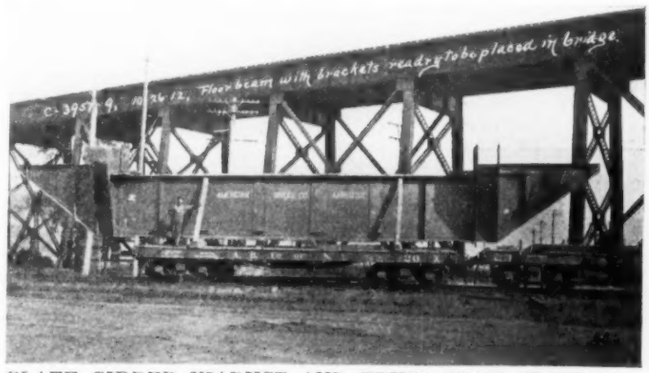


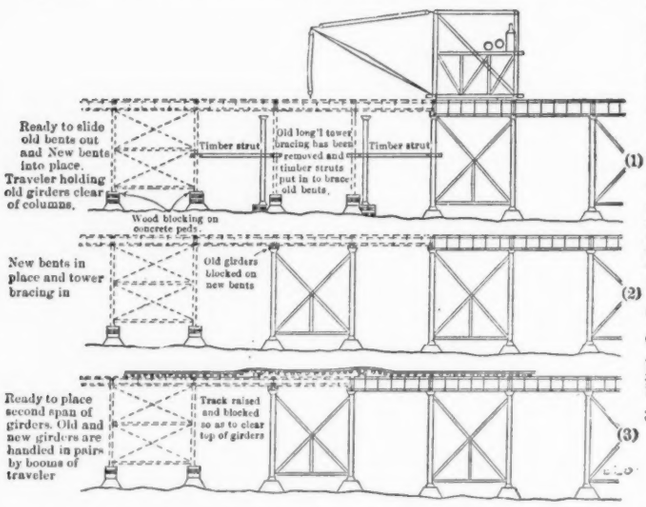
PLATE GIRDER VIADUCT AND TRUSS FROM CROSS BEAM.

The old longitudinal girders were securely fastened together end to end over the transverse bents, were detached from the latter and were raised a few inches to clear them by the tackles suspended from both booms of the traveler. This permitted the two old bents to be skidded transversely clear of the new viaducts by lines operated from the hoisting engine on the traveler which also skidded the new bents into the position where they were braced temporarily with wooden struts. All girders were lowered to temporary support on top of the new bents and train service continued, the operations having been conducted during an interval between regular trains.

REPLACING LONGITUDINAL GIRDERS.

The new transverse bents were braced longitudinally to complete the tower and the old tower bents were cut to pieces. The new longitudinal

girders were shipped from the bridge shop in pairs with cross bracing and diagonals riveted up complete. The track on the first span of the old girders was lifted at both ends and blocked up high enough to clear the entire length of the span, which being disconnected at the forward end was removed as a unit by one of the derrick booms while the other boom lifted from the ground and set in position on the new tower, the new pair of braced center girders. The outside girders, shipped separately,



SEQUENCE OF OPERATIONS IN REPLACING SINGLE TRACK VIADUCT BY DOUBLE TRACK STRUCTURE WITH SAME SPAN LENGTHS.

were erected, one by each boom, and traveler rails laid on them. The track was then again lifted at both ends, the blocking under it removed and the track lowered to final position on the new girders. Train service was then admitted to cross this span, and in the second span of old girders were replaced by new ones in the same manner, after which the traveler advanced two spans and repeated the operation and so on.

As all of these operations could be done in 20-minute intervals between regular trains and as none of them were commenced if a train was in sight, it was seldom necessary to hold trains at all and never for more than a few moments, and the work was carried on at the rate of two spans, or about 60 feet per day.

The new viaduct was fabricated and erected by The American Bridge Company, Wm. G. Grove and Henry Taylor, assistant engineers in charge. The engraving, illustrating the traveler and the old and new structures, the former indicated by dotted lines, is reprinted from the transactions of the American Society of Civil Engineers, Vol .79, Page 418.

Official Plan for New York Transit Companies Relief

Lewis Nixon, Public Service Commissioner for the First District, has submitted to the New York State Legislature a special report upon the traction situation in New York City in response to a concurrent resolution of the Legislature asking for such information. The report covers the results arrived at by Commissioner Nixon in his investigations as to whether it is possible for the traction companies to render adequate service at the present rate of fare. The report concludes that the Interborough subway, if operated as a single unit, could possibly survive under the present rate of fare, but that as a system it cannot avoid a receivership except by subordination of interest charges and through outside revenue. He finds that it is doubtful whether the New York Consolidated Railroad Company (B. R. T.) can continue at the present rate of fare as the contracts now are and pay interest on the bonds. He also states that it seems clear that the surface car lines throughout the city must have more revenue or their deterioration and disintegration will continue progressively. The report suggests a plan of reorganization of all the companies into one company for the entire city; or, if that is not possible, into two companies, one serving the Interborough Rapid Transit area and one the Brooklyn Rapid Transit area. Any increases in fare for the companies should be accompanied by corresponding concessions from them. A flexible cost of service fare should be established for a period of six months, all receipts therefrom to be used for cost of operation and maintenance, and not at all for dividends.

Trolley Lines Offered as a Free Gift

George A. Stanley, president of the New York and North Shore Traction Company, operating trolley lines from Flushing to Whitestone, and to Hicksville, in Nassau County, has offered his line to the city as a gift if the city will operate the road at a five-cent fare. He made this proffer at a hearing before the Public Service Commission for the First District, called to investigate the action of the company in ceasing service over all its lines. He stated that at many points the company's tracks were buried beneath several inches, and in some cases several feet, of ice, and that the company had no money with which to remove the encumbrances. He stated, however, that he was willing to resume service immediately after the snow had melted and the tracks were clear.

Combined Curb and Gutter Construction Method

Hanlon & Okes, contractors for paving at Worthington, Minn., have effected a considerable economy of labor by developing an improved method of making a monolithic curb and gutter. This is concreted in the usual manner in side forms with a 1x1½-inch continuous steel guide bar set against the inner space of the curb form at the top. After the concrete has been placed, the upper surfaces of curb and gutter with slope and fillet connecting them are covered with cement mortar and the latter is accurately screened by a transverse template with steel bearing surface, that is attached to a wooden cradle supported on the upper edges of the curb and gutter forms and kept in alignment by the guide strip. This provides for the required slope, curve and horizontal surfaces without floating and with very little troweling to satisfactorily finish them.

State Highway Construction in New York

By Jas. H. Sturdevant *

The first of three articles. In this one are described methods and appliances for making the survey, grading and rock excavation, and other features of the work required for preparing the sub-grade.

In New York State the state commissioner has entire jurisdiction over the location and construction of state highways and Federal routes, while the various boards of supervisors designate the roads and the order of construction of county roads, toward which they pay a percentage of cost; this percentage being based on area, mileage and assessed valuation, and varies for the different counties.

All new construction is performed by contract, and it is desirable to let the work in sections of five miles or more so as to justify the installation of first-class equipment for rapidly progressing the work. Under normal conditions a single concreting plant should build at least this amount of mileage of road surface during the working season.

ENGINEERING ORGANIZATION.

The organization of the New York State Highway Department consists of the commissioner, Capt. Frederick Stuart Greene, a first deputy in charge of new construction and maintenance, and a third deputy in charge of town and county roadwork. The state is divided into nine divisions, each in charge of a division engineer, with the necessary force of draftsmen, inspectors, etc., making for the entire department a personnel of over 1,000 men. In the first division, embracing the territory both sides of the Hudson river southerly from Albany to the end of Long Island, excepting New York City, there is a division engineer with headquarters at Poughkeepsie, three resident engineers, twelve county assistants, and from one hundred to one hundred and fifty engineers and inspectors, who have supervision of all the highway work in that division.

As most of the state roads are in well settled and easily accessible localities, reconstruction and new construction vary but little, except that the latter involves more clearing, grading and draining than the former; and in this discussion all of the elements that enter into new construction will be considered, although some of them may be absent in reconstruction work, even when the latter may substantially give an entirely new type of road.

The principal operations of road construction are survey, design, drainage, surfacing, and the necessary accompanying structures.

SURVEY.

In level, unobstructed country the roads may usually be located with a single survey, but in very hilly countries, or where there are many difficulties and obstructions such as ravines, rivers, swamps, buildings, railroads or other structures, it may be necessary to survey several lines, take levels and establish contours for an accurate typographical map on which the several lines are plotted, estimates made and the most advantageous location finally selected.

The base line of the survey should be definitely located by transit points tied in by horizontal measurements to at least three permanent tie points, well marked for future use in locating the new center line for construction. To this base line are referenced all structures, property lines, buildings, walls, etc. Cross-sections should be taken at least every 100 ft., and oftener if necessary to show breaks in grade, high banks, rock, etc. Permanent bench marks should be established not over 1,000 ft. apart, and may be made by chiseling crosses on ledge rock or large boulders, or by driving copper nails in bases of trees or permanent structures.

In locating a line, consideration must be given, of course, to materials and local conditions. The contracts should specify the quality and character of all materials and labor, describe the important operations, and give all the rules and requirements which the contractor must observe. They should particularly specify the mixing, placing and finishing of concrete or other road surface materials, and define the contractors' privileges and liabilities. The contractor should receive at least two copies of the specifications and blue prints showing all plans, profile, cross sections, structures and other details. For a permanent record, all details of final construction should be indicated on a set of prints mounted on cloth.

GRADING.

From the time that the grading is commenced, the assistant engineer or inspector in charge should be present constantly, and should stake well in advance of the construction; locating alignment and slopes, the latter having stakes driven about 100 ft. apart on each side of the center line and far enough away from it to be clear of construction operations and to afford permanent references when the center line stakes are necessarily removed. The side stakes should be inscribed with elevations and amount of cut or fill necessary, to enable the contractor with grade board and string to get the rough grading ready for instrumental checking by the inspector.

For light excavation, either on new work or improvements, the surface is generally plowed with

*Division Engineer of first division, Highway Department, New York State, in charge of 12,250 miles of roads in 8,000 square miles of the Hudson River locality.

teams, and for shallow cuts and short hauls up to 200 ft. it may be removed by wheel scrapers drawn by teams. For greater distances it is generally cheaper to haul the material in dump wagons. For long hauls, where the quantity of earth to be moved warrants it, dump cars on service tracks are usually provided.

In new work the plowing is generally started at the summits, the first furrows being made on the ditch lines, and successively continued to the center line of the road.

On heavy work the plows can be hauled by traction engines, one of which will do the work of three teams and do it more rapidly and satisfactorily. On reconstruction work it is frequently desirable to haul a heavy plow by the steam roller, when the latter is not in use for surfacing the finished work.

Where there is a sufficient quantity of excavation in ordinary soil on light grade, it is often done advantageously with special scrapers or graders, the latter often being of the elevating type drawn singly or in pairs by traction engines. Special excavation is usually required for ditches alongside.

In very heavy earth cuts, steam shovels are advantageous and may be operated on traction wheels or on service tracks. They may be fitted with skimmer buckets for very shallow stripping, even including the removal of old pavements only, or they may have ordinary buckets usually of ¾ yd. to 1 yd. capacity. Where the cut is deep enough and conditions are favorable, they are capable of excavating 1,000 yd. or more per day, providing that there is no delay in the removal of the spoil. Usually it is difficult to take away the excavated material as fast as the shovel can operate. This is especially true when it is delivered to horse-drawn wagons. Automobile trucks are more efficient if they can be continuously operated to and from the shovel, and for very large quantities or long distances, dump cars hauled by locomotives are the most efficient. Great care must be taken however to provide the continuous installation, shifting and maintenance of tracks so as to have cars always in attendance and ready for the loaded cars to be immediately side-tracked and promptly hauled away in order to make the operations continuous and uninterrupted.

Usually a good steam shovel will excavate very hard strata, including cemented gravel and some kinds of hardpan and decomposed rock without blasting, but if the strata are very refractory it will pay, even though it can be handled with the extreme effort of the shovel, to shatter it first with light charges of dynamite exploded in holes drilled to subgrade from 5 to 15 ft. apart according to local conditions.

ROCK EXCAVATION.

Rock excavation may be either loose rock and boulders or solid ledge rock. In small quantities it may be drilled by hand, but for amounts of 100 yd. or more in one place it is better to use jack-hammer drills operated by steam or by compressed air. On work of considerable magnitude, it would generally pay to install a central power plant from which compressed air is distributed up and down the line for the operation of drills, hoisting engines, concrete mixers, pumps and any other purpose. For small operations there are various types of portable air compressors driven by steam, electricity or gasoline engines.

When much blasting is necessary, a fire-proof, frost-proof, fool-proof magazine should be established at a central point and explosives placed in charge of an expert who will deliver them daily or oftener as required and be responsible for the proper handling and use. (In some cases explosives can be advantageously used for other purposes besides rock work, as in swamps and other places where ditches may often be made entirely by explosives without any hand work except for trimming.) After the rock has been shattered by blasting it can be loaded advantageously by the steam shovels. All blasting should be done by experienced workmen and shots should be fired by an electric machine. Various grades of dynamite are used according to circumstances, but 60 per cent nitro glycerine is usually suitable. About ½ lb. per yard will generally shatter cemented gravel or hardpan sufficiently to enable it to be excavated readily by the steam shovel, and about 1 lb. per yard is generally required for ledge limestone in open cuts, a larger amount being required for granite.

In open cuts it is usually desirable to excavate the rock to the full width and to a depth of at least 10 ft., making successive cuts if the depth is greater. In exposed positions the blast should be protected by rope mattresses or by logs chained together and placed on the surface of the rock before the holes are fired.

Improving New York Subway Service

Public Service Commissioner Lewis Nixon of the First District has issued an order directing the Interborough Rapid Transit Company to make material increases in the service which it renders on all of its subway lines, particularly in the non-rush hours.

The order calls generally for 10-car expresses instead of 8-car and 6-car trains practically throughout the daytime, non-rush hours.

A part of the service increase also covers service in evening, non-rush hours. Some increases are made in rush-hour local service. The tracks are now operated practically to capacity for express service during rush hours, and no material increase is possible during such period.

The service improvements directed by Commissioner Nixon will add to the service being operated in the non-rush hours a total of 600 cars more than are now operated in these hours and 30,000 more seats than are now furnished.

His order follows extensive investigations made by the commission into Interborough service. The commission gave the company until March 10 to determine whether it would accept the order and to March 17 to put the new service into effect.

In Switzerland reliable contractors of established reputation are invited to bid on public work and the contractor whose bid is nearest the average of all bids submitted, receives the contract. If it can be shown that any bid has been juggled, it is rejected and that bidder is not again invited to bid on public work for a specified time.

Annual Paving Statistics

Facts and figures from several hundred cities concerning the amount and nature of work done by each during 1918. (Fifth instalment.)

TABLE NO. 12—LABOR AND CONTRACTING.

City and State	Increase in Cost, Percentage	Common Labor — Available	Common Labor — Prevailing Price in 1919 — Per Hour or Day	Common Labor — Prevailing Price in 1919 — Hours per Day	Kinds of Pavement Laid by Day Labor	Kinds of Pavement Laid by Contract
California:						
Chico	...	500	$4.00	8	...	...
Oxnard	33	...	3.75-4.00	9	...	All
Palo Alto	70	Very few	6.00	8	None	None
Pasadena	100	None	3.50	8	...	All
Redlands	...	300	3.25-4.00	9	...	...
San Francisco	...	...	5.00	8	None	All
Santa Barbara	20	600	4.00	8	None	All
Santa Monica	43	Scarcity	4.00	8	None	All
Vallejo	50	50	5.00	8	None	All
Colorado:						
La Pinta	...	...	4.00	10	...	...
Leedville	...	100	3.50	8	...	...
Pueblo	12	...	3.25-4.00	8	...	All
Connecticut:						
Greenwich	50	...	5.00	9	None	All
Hartford	...	...	4.50	...	Concrete and macadam	Sheet asphalt and granite block
New Camden	...	None	5.40	9		None
Stamford	50	...	4	8	By municipality	None
Florida:						
Orlando	60	None	3.00	10	All	None
Idaho:						
Boise	35	...	4	8	None	All
Illinois:						
Mt. Carroll	...	25	4	10	...	...
Winnetka	...	30-35	7	9	...	All
Iowa:						
Atlantic	100	...	5	10	...	All
Centerville	100	...	3.60	9	None	All
Charles City	...	50	5.00	10	...	...
Indianola	...	...	4.00	8	...	...
Sioux City	...	Enough	4.50-5.50	9	None	All
Kansas:						
Parsons	25	Few	3.75	8	None	All
Topeka	100 plus	Not enough	4	8	None	All
Wellington	...	75	4	8	None	None
Kentucky:						
Madisonville	35	300	2.50	9	Cinder, clay, macadam	2-3 macadam
Maryland:						
Hagarstown	100	...	4.00	10	All	None
Massachusetts:						
Cambridge	100	...	4.00	8	All except bithulithic	Bitulithic
Greenfield	...	...	3.50-4.50	8	All	None
Haverhill	50	...	3.75	8	All	None
Lawrence	...	...	4.00	8	Granite block and tar macadam	Bitulithic
Lexington	25	...	3.50	8	All	...
Pittsfield	50	Unknown	4.00	8	Asphaltic macadam	
Winchester	80	Unknown	4.00	8	All	None
Michigan:						
Kalamazoo	75	...	$0.50	9	Municipality	...
Minnesota:						
Duluth	60	...	0.45-0.55	...	Macadam	All other
Northfield	...	Enough	4.00	10	...	...
Missouri:						
Poplar Bluff	25	Very few	0.425	...	All	None
Montana:						
Bozeman	35½	...	4.50	8	None	All
Nebraska:						
Columbus	...	Scarce	4.50	10	...	All
Grand Island	...	...	0.50	9	None	All
Lexington		50	5.00	9	...	All
New Hampshire:						
Nashua	30	150	3.60	8	All	None
New Jersey:						
Irvington	70	...	5.00	9	None	All
Ridgefield Park	Amesite 100	...	5.25	8	None	All
Ridgefield Park	Tarvia X 50	...	5.25	8	None	All
West New York	60	20	5.00	8	None	All
New York:						
Batavia	...	Plenty	3.20	8	...	...
Buffalo	36-68	...	4.50	9	None	All
Corning	...	50	3.20	8	...	...
Depew	Nearly 100	50-100	0.45	...	...	All
Gloversville	90-100	Very few	3.60-4.00	9	None	All
Bronx, N. Y. City	...	...	4.50	8	None	All
Man., N. Y. City	Asphalt 92 Granite 58 Wood 60	...	4.00-4.25	8	None	All

TABLE NO. 12—LABOR AND CONTRACTING—(Continued).

City and State	Increase in Cost, Percentage	Common Labor Available	Prevailing Price in 1919 Per Hour or Day	Prevailing Price in 1919 Hours per Day	Kinds of Pavement Laid by Day Labor	Kinds of Pavement Laid by Contract
New York:						
Rich., N. Y. City	100-250	...	5.00	8	None	All
N. Tonawanda..	71	...	0.50	10	...	Bitulithic
Oneonta	100	...	3.60	8	...	All
Port Jervis.....	...	...	...	...	All	None
Syracuse	70	1000	4.00	8	None	All
Troy	...	...	4.00	19	All	None
Waverly	90	None	3.50	10	All	None
North Dakota:						
Bismark	90	Very few	5.00	10	None	All
Minot	33⅓	300	5.00	10	...	All
Ohio:						
London	65	...	4.00	8	None	All
Oklahoma:						
Enid	20	100	4.40	8	None	All
Oregon:						
Ashland	...	...	4.50	8	...	...
Eugene	70	Plenty	4.50-5.00	8	None	All
Pennsylvania:						
Athens	90	None	3.50	10	None	All
Bridgeport	...	Scarce	4.80	8	...	...
Butler	55	...	3.60	9	Resurfacing	New work
Duquesue	50-52	Uncertain	5.00	9	None	All
Johnstown	115	No surplus	4.50	9	None	All
Mechanicsburg..	30	Very few	2.75	10	All except brick	Brick
Pottsville	...	...	3.00	8	...	...
Rhode Island:						
Providence	...	...	...	...	Granite block and macadam	Sheet asphalt
South Carolina:						
Columbia	100	Unknown	3.00	10	None	All
Tennessee:						
Harriman	...	...	2.50	10	None	All
Texas:						
Brownwood	...	None	3.50-4.00	8	...	...
Port Arthur ...	33⅓	...	3.50	8	Gravel top shell	None
Temple	50	200	3.00	8	Brick	...
Utah:						
Salt Lake City..	50	Sufficient	4.00	8	None	All
Vermont:						
Burlington	About 100	500	3.25	9	All	None
Virginia:						
Newport News..	...	Very few	4.00-4-50	10	...	Concrete
Washington:						
Chehalis	...	50	5.00	8	None	All
Dayton	100	Few	5.00-8.00	8	...	All
Port Townsend.	...	...	4.00-4.50	8	...	...
Raymond	70	100	5.50	8	Replanking	Concrete
Seattle	50	...	5.50	8	9,740 yd. concrete	All remainder
Spokane	62	4,000	4.50	8	None	All
Walla Walla	65	Enough	5.00	8	None	All
Waterville	20	...	5.00	8	None	Gravel
Winlock	100	None	4.50	8	...	All
West Virginia:						
Fairmount	80	300	0.50-0.55	8	None	All
Huntington	115	...	4.00	10	...	All
Moundsville ...	100	Scarce	3.00-4.00	9	None	All
Wisconsin:						
Wausau	33	...	4.25	10	Tar macadam	Brick
Wyoming:						
Sheridan	50-100	...	4.00-7.00	10	None	All

Table No. 8—Tar or Asphalt Macadam Laid in City Streets During 1919.

City and State.	Yards or miles laid	Av. Cost sq. yd.	Thickness inches	Gallons, per sq. yd.
California:				
Redlands	....	...	5	1¼
Santa Barbara	2,700	$0.45	2	½
Connecticut:				
Greenwich ...	14,000	1.79	3	2½
Stamford	1¼	1.00	3½	2¼
Massachusetts:				
Greenfield ...	3,984	1.125	6	2
Haverville ..	2,890	1.67	2¼	2
Lawrence	86,746	1.15	3 stone	1½-1¼a
Lexington ...	6,816	0.90	4-5	2.2
Pittsfield	200	...	..	2
Winchester ..	5,800	0.85	..	1½
New Jersey:				
Ridgefield Park	19,000	1.70	6	2¼
New York:				
Richmond Borough, N. Y. City	3,006	2.00	6½	2
Oneonta	11,000	1.85	7	1.75-2.25
Rhode Island:				
Providence ..	12,227	...	3	2¼
Tennessee:				
Harriman	3,750	0.80	..	2½
Vermont:				
Burlington ...	8,500	1.00	3	2
Wisconsin:				
Wausau	4,000	...	8	..

a—Binder 1½ and sealed coat 1¼ gal. Tarvia. Work done by day labor. Does not include grading or other work.

Tension Splice for Timber

A new splice for wooden tension members that has been designed by S. Murray, chief engineer of the Oregon-Washington Railroad & Navigation Co., is intended to provide high efficiency, a shrinkage adjustment and to prevent decay.

A pair of cast iron plates gained into the surface, are securely bolted to opposite sides of each timber near the splice. They are provided with outstanding flanges having reinforced bearings for pairs of screw rods proportioned to take the full tensile strength of the next section of timber and are adjustable to compensate for any shrinkage. For a 10 x 12-inch timber the 12-inch plates are located 18 inch clear of the joints and are connected by four 1⅜-inch round rods.

Leadville, Colorado, in 1919 laid a half-mile of gravel by volunteer labor aided only by the city truck. The gravel was taken from a neighboring mine dump, the mine owners making no charge for it. It was spread on the road to a depth of about six inches and was packed down by traffic,

United States Civil Service Examinations

An examination will be held on April 6, 1920, for the position of assistant fuel engineer for the Bureau of Mines, Department of the Interior at Pittsburg, Pa., at a salary of $4,200 a year. Applicants must be graduates in mechanical engineering from a college or university of recognized standing and have had at least one year's experience in work dealing largely with fuel engineering and the management of boilers and furnaces. Apply for Form 2118.

An examination will be held April 13, 1920, for assistant specification engineer for vacancies in the office of the Chief Signal Officer, War Department, Washington, D. C., at $1,200 to $2,000 per year. Apply for Form 2118.

An examination will be held April 13, 1920, for junior mechanical engineer for a vacancy at the National Advisory Committee for aeronautics, Langley Field, Virginia, at $1,800 a year. Apply for Form 1312.

An examination will be held April 13, 1920, for fuel research assistant for vacancies in the Bureau of Mines, Department of the Interior, throughout the United States, at a salary of $1,200 to $1,800 a year. Apply for Form 2118.

In all the above cases, both men and women, if qualified, may enter the examinations, but appointing officers have the legal right to specify the sex desired in requesting certification of eligibles. Positions requiring similar qualifications at these or higher or lower salaries will be filled from these examinations unless it is found to be in the interest of the service to fill vacancies by reinstatement, transfer or promotion. All applicants should immediately apply for the application forms required, stating the title of the examination desired, to the Civil Service Commission at Washington, D. C., Secretary of the U. S. Civil Service Board, Custom House, Boston, Mass., New York, New Orleans, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, Seattle, San Francisco, St. Louis.

80-Foot Concrete Flag Pole Cast Vertical

At Ancon, in the Panama Canal Zone, an 80-foot reinforced concrete flag pole 17 inches in diameter at the base and 8½-inches at the top was successfully cast in place in vertical position to avoid the difficulty and strains that would have been involved in revolving it from horizontal to vertical.

A pit 10 feet deep was dug to receive the base of the pole and concentric with it there was erected a wooden falsework tower more than 70 feet high above the surface of the ground. The tower was made of the usual hoist tower type with four corner posts braced by horizontal and diagonal members on every side, and the base of the tower was braced by pairs of inclined struts connected to the corner posts 10 or 15 feet above the ground.

The 8 reinforcement bars diminishing in size from the base to the top were assembled full length in position and stayed there while the wooden forms made in longitudinal halves in sections 8½ feet long were assembled and concreted at the rate of about 1 section per day, great pains being taken to do the work accurately and to plum the forms by means of two transits.

Concreting an Old Highway Bridge Floor

A steel truss highway bridge of 56 feet span with a roadway 14 feet wide, carries the Staunton-Parkersburg Pike across Mill Run, near Parkersburg, West Virginia. It needed a new floor when the engineers, Woodyard & Alexander, were preparing to pave the Pike with concrete in 1916, and rather than continue the expense of flooring it periodically with planking it was decided to carry the pavement right across it. Accordingly the grade of the road was fixed at 10 inches above the tops of the floorbeams, 4 inches above the tops of the 6-inch I beam stringers that rest on the top flanges of the 15-inch I-beam floorbeams.

When the paving mixer came to the bridge it was run up on heavy planks laid on the old floor and the pavement was completed to the abutments of the bridge. Then the flooring in front of the mixer was quickly removed and a section of false floor was slung into place under the stringers. The reinforcing, ¾-inch twisted bars, was laid 8 inches apart in both directions and wired together on top of the stringers, sagging down between them.

The concrete was placed just as though the floor was a portion of the road, and when a section was poured the mixer was moved along and another section treated in the same way, until the slab was completed for the entire length of the bridge. The stringers are encased with concrete except their lower flanges. From the time the first flooring was removed until the last concrete was poured, was two hours and twenty-eight minutes.

Laying a Mountain Pipe Line

In laying a 12-foot pipe line in the Adirondacks, a public service corporation used a small movable derrick mounted on a portion of the pipe already built, and operated by an electric hoisting engine and hand crab. The pipe was of 9/16 to 11/16-inch steel plates, in sections 7½ feet long. Five complete rings could be erected at one setting of the derrick, which erected as many as three rings in a 9-hour day.

The derrick had one stiffleg resting on the pipe and was side-guyed to adjacent trees with light wire rope tackles. The foot block was bolted through open holes in one of the pipe seams, and at the foot of the stiffleg there was a heavy bent strap with a number of connection bolt holes in the horizontal leg. The mast was adjusted vertically on the various grades encountered by bolting through the proper holes in the strap to the open holes of one of the seams back of the stiffleg.

Hall county, Nebr., expended about $6,000 on the purchase of a traction machine, two graders, seven dump wagons and four scrapers that were used on the construction of 32 miles of State and Federal Aid highways during 1918. In 1919 the equipment was supplemented by about $5,000 worth of new plant and the 1918 cost of 30c a yard for grading was reduced last year in one case to about 21c, and in another case to about 12c. The gravel surface was contracted for at cost plus 15 per cent.

LEGAL NOTES

A Summary and Notes of Recent Decisions—

CONTRACTOR NOT EXCUSED BY MISLEADING SPECIFICATIONS.

RE:—CHARLES H. SEMPER vs. DUFFY, State Commissioner of Highways. New York Court of Appeals, Oct. 14, 1919. A bidder for state highway construction who agreed in his itemized proposal for the work that his accompanying certified check should belong to the state if he failed to execute the contract; that his information regarding materials "was secured by personal investigation and research and not from the estimates of the state," and who thereafter refused to execute the contract on the ground that the state's estimate sheet mistakenly indicated that stone for the job could be had at a certain place and for a certain price, is not entitled to a return of his certified check.

Pound, J—Relator was a bidder for the construction of a state highway. The estimate sheet exhibited by the state commission of highways to contractors indicated in entire good faith that the supply of stone necessary therefore could be obtained at Union Springs at 90 cents the cubic yard. That was a mistake, as relator discovered after making his bid. It could only be obtained elsewhere at a much higher cost. He refused to execute the contract and now seeks to recover a certified check for $1,450 which he deposited with his proposal, to become the property of the state if his proposal was accepted and he failed to execute the contract. It has been held below that his proposal was due to a misunderstanding on his part or a mutual mistake of fact as to the possibility of obtaining the stone at Union Springs according to the estimate and that it was the clear legal duty of defendant to return the check.

I reach the conclusion that no mistake or misunderstanding as to the place where the relator could obtain stone will avail him in his proceeding. His itemized proposal states that he has carefully examined, among other things, "the form of contract," and that the certified check accompanying the bid "shall become the property of the state if his proposal is accepted and he fails to execute the contract." He thus binds himself to enter into a contract in and by which he agrees that his information "regarding all the conditions affecting the work to be done and labor and materials to be furnished for the completion of this contract was secured by personal investigation and research and not from the estimates of the state commissioner of highways; and that he will make no claim against the state by reason of estimates, tests or representations of any officer or agent of the state." It thus appears that the proposal was so related to the contract that the contractor was precluded from relying on the statement in the estimate that stone would be obtained at a given place at a given price. The statement was suggestive merely, directing him for inquiries to what the state considered the nearest available source of supply. The bidder had the same opportunity to discover the facts that the state had, and he in his proposal agreed to execute a contract to the effect that he had availed himself of his opportunity and was content to make the proposal and to execute the contract upon the understanding that he was relying on his own personal investigation.

We held in Faber vs. City of New York (222 N .Y., 255, 260) that where the contractor had no reasonable opportunity to discover the truth as to the position of bed rock, and the evidence was sufficient to show that the bed rock was as indicated in the plan prepared by the city, the contractor might recover for extra work, but here the parties had an entire equality of opportunity. The case is the same as any mutual misunderstanding as to price, source of supply and the like. The proposal is made at the bidder's risk in these regards, certainly where no element of deception or inequality or inequity is presented. The bidder has forfeited the money accompanying his bid by failing to execute the contract. The result may seem harsh, but the state properly protects itself by the strictness of its contract, and the relator must be bound by the terms thereof as proffered.

The orders of the Special Term and the Appellate Division should be reversed, and the application for the writ of mandamus denied, with costs to appellant in all courts.

Hiscock, Ch. J.; Chase, Cardozo and Andrews, J. J. concur;

Hogan, J., absent; McLaughlin, J., not voting.

Orders reversed, etc.

SURETY BONDS FOR FAITHFUL SERVICE DOES NOT COVER PRESENT CLAIMS.

In Village of Argyle *vs.* Plunkett, 124 N. W. R., Page 1, the Court of Appeals of New York held that where a bond was conditioned merely for the faithful performance of the contract and contained no obligation of suretyship for the payment by the contractor of his debts incurred in the work the surety company was not liable to the village because of the contractor's failure to pay for labor and material. The Court pointed out that the village had no personal interest in the unpaid claims, that it had not paid any of them, and that it was not personaly liable for their payment, that the liens filed were simply against any underpaid balance on the contract.

The judgment of the Appellate Division, which had affirmed a judgment for the plaintiff, was reversed and the complaint dismissed.

RESPONSIBILITY FOR LIVE WIRES.

RE:—SWACZYK vs. DETROIT EDISON COMPANY. Supreme Court of Michigan, Oct. 6, 1919. P. 197 NWR 174. A charge, in an action by the administrator of a small boy, who died as a result of coming in contact with a live wire, that, if anybody is furnishing electricity as furnished by the defendant, a very high degree of care is enjoined, perhaps the highest degree of care which is reasonably practical, held, correct not imposing an undue standard on defendant, but merely requiring reasonable care under the circumstances, considering the hazards of the business.

NEWS OF THE SOCIETIES

March 15.—RAILROAD CONFERENCE. Second annual conference will be held at Congress Hotel, Chicago, auspices of American Association of Engineers, 63 East Adams street, Chicago.

March 16-18. — AMERICAN RAILWAY ENGINEERING ASSOCIATION. Manhattan Building, Chicago.

March 24-25. NATIONAL WHOLESALE LUMBER DEALERS ASSOCIATION, Washington, D. C. Secretary, 66 Broadway, New York.

March 24-25.—NATIONAL FEDERATION OF CONSTRUCTION INDUSTRIES. The first annual meeting at Chicago. Executive Secretary, John C. Frazee, Drexel Building, Philadelphia, Pa.

March 24-26. SOCIETY OF INDUSTRIAL ENGINEERS, Bellevue-Stratford Hotel, Philadelphia. Secretary, 327 South La Salle St., Chicago.

March 25. NORTH CAROLINA PINE ASSOCIATION, Norfolk, Va. Secretary, Norfolk, Va.

April 12-17. — UNITED STATES GOOD ROADS ASSOCIATION. Eighth Annual Convention, Hot Springs, Ark. Director-General, J. A. Rountree, 1021 Brown-Marx Building, Birmingham, Ala.

April 16-17. — BANKHEAD NATIONAL HIGHWAY ASSOCIATION. Fourth Annual Convention, Hot Springs, Ark. Secretary, J. A. Rountree, 1021 Brown-Marx Building, Birmingham, Ala.

May 10-11.—AMERICAN ASSOCIATION OF ENGINEERS. Sixth Annual Convention, St. Louis, Mo. Secretary, C. E. Drayer, 63 East Adams Street, Chicago.

May 13-14-15.—LEAGUE OF TEXAS MUNICIPALITIES.

May 18-21.—NATIONAL ELECTRIC LIGHT ASSOCIATION. Annual convention, Pasadena, Cal. Acting Secretary, S. A. Sewall, 29 West 39th Street, New York City.

June 22. JOINT COMMITTEE ON STANDARD SPECIFICATIONS FOR CONCRETE AND REINFORCED CONCRETE. Next meeting at Asbury Park. Secretary-treasurer, D. A. Abrams, Lewis Institute, Chicago.

Indiana Sanitary Water Supply Association.

At the 13th annual meeting, held at French Lick, Ind., March 8 and 9, the program included address by President John W. Toyne; report of Committee on Water Workers Devices and Machinery; Round Table Discussion. Water Meters. Service and Repairs, led by Dow R. Gwinn, Charles Winkle; Rebuilding Water Works Power Plants, Charles Brossman; Service Control by the Indiana Public Service Commission, M. D. Atwater; Growth of Water System at Gary, Ind., W. S. Luscombe; Pitometer Survey of the Evansville Water System, Charles Streithof; The National Board of Fire Underwriters' Method of Rating Cities on Fire Service, Clarence H. Goldsmith; Round Table Discussion—Reduction of Fire Loss in American Cities, led by William J. Curran, Superintendent of Indianapolis Salvage Corps, Indianapolis, Ind.; Supervision of Water Filtration in the State of Ohio, F. Holman Waring; Sewage Disposal in Indiana, J. B. Marvin; Progress in Construction of Indianapolis Sewage Disposal System, Jay A. Craven; Advantages of an Association of Public Utilities, J. N. Wells; Round Table Discussion—Present Limitations of Financing Public Utilities, led by E. L. Loomis, Dow R. Gwinn, Howard W. Painter; Water Service of the American Troops in France, Edward Bartow; The Production of Bottled Mineral Waters, L. R. Taylor; Sanitary Improvements in Indiana, M. V. Ziegler, discussion led by Robert E. Tracy; The Post-War Duties of the U. S. Public Health Service, Dr. L. L. Lumsden, surgeon, U. S. Public Health Service; Co-operation Between the Health Officer and the Water Works Superintendent, Dr. Hugh A. Cowing, president Indiana State Board of Health, Muncie Ind.; discussion led by Dr. W. F. King, Assistant State Health Commissioner, Indianapolis, Ind. Odors and Tastes in the Danville Water Supply, Edward Bartow; Fifteen Years' Operation of Slow Sand Fillers at Indianapolis, H. E. Jordan; report of Committee on Water Purification, W. H. Durbin.

Railroad Engineers' Conference.

At least 50 per cent. of the 52 railroad sections of the American Association of Engineers will send delegates to the second annual railroad conference to be held in the Congress Hotel, Chicago, on March 15. The total membership of the railroad sections of the association is in excess of four thousand. The seven largest sections in point of membership are the Pennsylvania, the New York Central, the Chicago, Burlington and Quincy, the Southern, the Baltimore and Ohio, the Chicago and Northwestern and the Illinois Central. Among the speakers and subjects are:

"Plans for A. A. E.'s Future Railroad Work," by G. W. Hand, chief engineer of the Northwestern Railway. Discussion by J. B. Jenkins, valuation engineer of the Baltimore and Ohio, and F. E. Morrow, chief engineer of the Chicago and Western Indiana.

"A. A. E. Railroad Salary Schedule," by W. C. Bolin, of the association railroad committee. Discussion by R. W. Barnes, principal assistant engineer of the Southern Pacific; C. F. Bowler, president of the Burlington Lines East Railroad Section; A. M. Knowles, president of the Erie Railroad Section; O. R. West, president of the Santa Fe Coast Lines Section.

"Railroad Sections—Their Organization and Function." The speaker is not selected.

"Railroad Sections—Their Relation to the Railroad Management," by F. C. Huffman, president of the Chicago and Northwestern Railroad Section.

"Railroad Sections—Their Relation to the Chapters," by Paul Augustinus, past president of the Chicago Chapter.

These subjects will be presented at the afternoon session, of which J. R. Leighty, chief engineer of the Missouri Pacific, will be chairman. The morning session, which will be in charge of W. W. K. Sparrow, assistant chief engineer of the Milwaukee, will be devoted to registration, reports and a resume of the accomplishments of the association in railroad work during 1919 by D. A. Tomlinson.

At the evening session, at which W. H. Hoyt, chief engineer of the Duluth, Missabe and Northern Railroad, will preside, Dr. F. H. Newell, president of the association, will speak on the "American Association of Engineers—Its Aims and Ideals." Other speakers at the evening session will be Arthur S. Tuttle, chairman; Bion J. Arnold and Oscar C. Merrill, members of a committee to represent Engineering Council.

S. M. Felton, president of the Chicago Great Western Railroad, will speak on "Problems of the Railroads Since Their Return to Private Control."

Engineers' Architects and Constructors' Conference on National Public Works.

This conference is a federation of engineering societies. The term "Engineering" is here used in the broadest sense to include:

1. Professional engineers and architects.
2. Technical men, such as geologists, physicists, chemists and research engineers.
3. Builders and constructors.
4. Operators of engineering enterprises and properties.
5. Producers of raw material used in engineering works.
6. Manufacturers and merchants of engineering plant and equipment.
7. Allied business associations.

There were represented at the formation of the conference in Chicago, April 23-25, 74 technical societies with a membership of 105,000.

The conference seeks to educate the people concerning the need of consolidating the vast public enterprises of the nation under one central department, which would be known as the Department of Public Works.

The conference has appointed an Executive Committee, whose headquarters are in the McLachlen Building, 10th and G streets, Washington, D. C., and has had prepared and introduced into Congress the "Jones-Reavis" bill, creating a national Department of Public Works. This bill, Senate No. 2232, House No. 6649, was introduced on June 25 by Senator Jones, of Washington, and Mr. Reavis, of Nebraska.

The Third Nebraska Road Institute.

The purpose of the Nebraska Road Institute is to aid in supplying information to highway commissioners and engineers relating to the construction and maintenance of Nebraska's roads. It is hoped that this institute will be instrumental in bringing together for open discussion, commissioners and engineers, and that each will be made to see more clearly the duties assigned him and as a result attempt to execute them harmoniously and efficiently. The lectures and papers will be presented by highway engineers and commissioners who are specialists in their line; men of broadest experience and widest reputation. They have been selected because of their ability to handle the subject assigned to them. The list includes, aside from the special lectures from other states, engineers from the Nebraska Department of Public Works and members of the faculty of the University of Nebraska.

The American Association of Engineers.

The Philadelphia Chapter has elected the following officers for 1920: President—Edmund J. Fitzmaurice, of the firm of Ballinger and Perrott, architects and engineers; first vice-president—J. J. Crowe; second vice-president—Jos. Chapin; third vice-president—E. E. Keller;

recording secretary—H. H. Cramer; treasurer—Jesse R. Henderson; executive secretary—H. F. Kuzen.

The following officers have been elected for 1920 by the Ogden, Utah Chapter: President—W. F. Turner; vice-president—H. J. Craven; secretary—E. H. Kidder; assistant secretary—B. W. Matteson; treasurer—W. S. Craven.

The Swarthmore College Engineers' Club voted on February 11 to affiliate with the American Association of Engineers as a student chapter. At present there are about twenty-five or thirty members and it is expected that this membership will be increased to eighty soon. Edmund P. Smith is president; Howard Jenkins is vice-president, and Edmund E. Bartleson, secretary and treasurer. The club was founded about 1914 to promote the interests of students in engineering.

A large and successful local meeting was held by the Milwaukee Chapter of the American Association of Engineers on February 24. The triple attraction of a meeting advocating ethical organizations of engineers as opposed to unions, Isham Randolph, eminent consulting engineer of Chicago, and Secretary C. E. Drayer of the American Association of Engineers resulted in an attendance of 700 or more engineers of Milwaukee, Racine and Kenosha.

Organization of engineers for the promotion of their economic interests was advocated by Doctor Randolph, who deprecated the tendency of some of the embryo engineers to become affiliated with union organizations. Mr. Drayer pointed out the splendid results that have been accomplished by the American Association of Engineers. He outlined the work of the service department, of the railroad department which has obtained substantial increases for a great majority of the railroad professional engineers of the United States, and touched upon the other activities of the association.

The Ohio State Assembly, composed of the eight chapters and two clubs of the association in that state, adopted a constitution at its second meeting in Columbus on Feb. 28.

The following officers were elected: C. R. Rood of Toledo, president; J. E. Root of Akron, first vice-president; E. K. Ruth of Cincinnati, second vice-president, and W. L. Mattoon of Columbus, secretary-treasurer.

The Cambridge, O., Club held a banquet and meeting on February 25. Among the speakers were Francis E. Sheehan, superintendent of the Cambridge Filter Plant; E. C. Murray, general superintendent of the National Coal Company; W. A. Faucett, division engineer of the State Highway Department; A. R. McCulloch, chairman of the advisory board of the State Highway Department; District Secretary F. E. N. Thatcher of Pittsburgh; and H. J. Shaw, division engineer of the Marietta division of the Pennsylvania Railroad.

The Trenton, N. J., Club was organized on February 20 at the Trenton Engineers' Club. Officers were elected as follows: President, H. D. Robbins, division eningeer, State Highway Department; secretary R. R. Pope, resident engineer, State Highway Department; and treasurer A. G. Nicolaysen, State Board of Taxes and Assessments.

Resolutions were adopted urging Congress to support and make effective the reclassification recommended by the Keating Commission, asking the Senate conferees on the Water Power Bill to recede from the Senate amendment providing that the secretary of the Water Power Commission be an army engineer and encouraging the House conferees to stand behind the original provisions of the bill, and urging the Congressional committees considering the Jones-Reavis Bill, providing for a national department of public works to approve the bill.

The Bismarck, N. D., Chapter was organized on February 20 with J. E. Kaulfuss, assistant chief engineer of the North Dakota Highway Commission, president; B. H. Long, vice-president; G. F. Ludvigsen, assistant engineer, North Dakota Highway Commission, secretary; W. T. Stratton, consulting engineer, North Dakota Railroad Commission, treasurer. The usual committees were appointed, including one on licensing.

The Albany, N. Y., Chapter of the A. A. E. has elected O. F. Rowland, president; R. N. Barrett, secretary; and R. E. Harman, treasurer. Six vice-presidents were elected.

The first action of the chapter after organizations was a resolution supporting the Jones-Reavis Bill which is to be forwarded to the representatives of the chapter in Congress. The membership of the chapter increased 25 per cent. within eighteen hours after the meeting.

North Dakota Society of Engineers.

At the 12th Annual Convention, Grand Forks, N. D., March 10 and 11, the program included the address of welcome by Mayor H. M. Wheeler, response in behalf of Society, and president's address, by J. A. Jardine. Preliminary reports of committees on possible affiliation with American Association of Engineers, Municipal Improvements, Highways and Bridges, Architectural Engineering, Electrical Development, Fuel, Clay Products and Brick, Field Survey Methods, Drainage, Legislation Standardized Fees, and Per Diem for Engineering Services.

Papers were presented on the New Water and Sewer System Regulations of the State Board of Health, by I. W. Mandelsohn, The Proposed National Department of Public Works, by D. R. Jenkins, Operation and Maintenance of Utilities in the Army Cantonments, by F. L. Anders, Sanitary Work in Epidemics, by Samuel Claman, Concrete Aggregates in North Dakota, by A. G. Leonard, The Relation of Architects to Engineering Work, discussed by several architects and engineers. Increased Costs of Material used by Public Utility Companies, by C. A. Thompson, and Present Status of Irrigation in North Dakota, by J. M. Hansen.

There was a Good Roads Dinner, under auspices of Good Roads Committee of Commercial Club, County and State Highway Officials and Society Members to consider roads, and federal highway plans and policies, and inspection trips were made to the new plant of the Northern Packing Company and other places.

The Northwestern Association of General Contractors.

The annual convention was held in Minneapolis, February 23. Ralph Budd, president of the Great Northern railway gave an address on railroads; C. M. Babcock, commissioner of highways, talked on highways; Royal A. Stone, of St. Paul, discussed Contracts, and John H. Rich, president of the Federal Reserve Bank, spoke on The Financial Situation. A banquet followed.

American Concrete Pipe Association.

The annual convention was held in Chicago, February 20 and 21. Following officers were elected for the coming year: President, A. N. Shearman, Knoxville, Tenn.; vice-presidents: Ernest Bent, Los Angeles, Calif.; Harry K. Cain, Mankato, Minn., and A. M. Hirsh, New York City. Executive Committee: C. F. Buente, Pittsburgh, Pa.; W. A. Curless, New York Ciy; J. J. Hammen, Spencer, Iowa; Arthur McHose, Boone, Iowa; J. E. Moody, Chicago; J. L. Zeidler, St. Joseph, Mo.; W. J McCracken, Luverne, Minn; W. E. Goodman, Saginaw, Mich., and F. J. Lawson, Oxford, Ind. Manager, G. E. Warren, 210 So. La Salle street, Chicago. Association membership has increased and new office in Chicago will be opened.

NEW APPLIANCES

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations.

United Iron Works Co.

This company manufactures non-vibrating, double stroke, deep well power pumps listed in six sizes having cylinders 3 to 24 inches diameter, 70 to 110 inches long that are operated at 33 to 10 R. P. M. according as the depth below the surface of the location of the cylinder varies from a minimum of 50 to a maximum of 800 feet. They have capacities, under these heads varying from 30 to about 2,200 gallons per minute. They are recommended for reliability of service, durability, and efficiency. They are suitable for municipal and public service waterworks plant, tunnel draining, shaft sinking, railroad water supply, boiler feed, irrigation, drainage, and fire protection.

They are designed to be operated with any kind of power and are fitted with plain or friction clutch pulleys, gears, pockets or other transmission devices. The power head is placed at the top of the well, shaft or pit and the cylinder or working part, is placed below water level in the well. The plungers may be removed for repacking without withdrawing them through the top of the column pipe which can be placed in the corner of the shaft. The column of water passing through the cylinder never comes to rest while pumping is maintained and the duplex system with long overlapping strokes gives an uninterrupted movement of the column of the water and a continuous discharge.

Morris Knowles, Inc., Seventh Annual Dinner.

About 80 officials and employees of the organization of Morris Knowles, Inc., prominent engineers of Pittsburgh, Pa., assembled Feb. 14 in the banquet hall of the University Club. Toastmaster Joseph Henry White called upon Morris Knowles, president and chief engineer of the organization, who made brief mention of the earlier times when the first dinner of the organization was held in 1914 with ten present. Mr. Knowles announced final arrangements for the consolidation of the organization of Morris Knowles, Inc., with that of the late R. Winthrop Pratt, of Cleveland. The Cleveland office will continue to be operated, but under the name of Morris Knowles, Inc., and will be under the direct supervision of R. F. McDowell and R. E. Garvin, who were continuously associated with Mr. Pratt up until the time of his death. The various branch offices established by each organization will be continued with the possibility of others being added.

Although both offices have done important work in connection with water supplies and water purification projects, sewerage systems and drainage, Mr. Pratt's organization has had especially helpful experience in garbage and sewage disposal plants, sewerage systems and waterworks, while Morris Knowles, Inc., has developed strong departments of town planning, industrial housing, flood prevention, valuation and rate making, and appraisals. This consolidation results in a personnel of 130 and places the organization of Morris Knowles, Inc., among the largest engineering firms of the United States and Canada.

Blaw Single Line Buckets.

Blaw single line buckets may be operated with a single hoisting drum and may be hooked on the block of any crane, derrick, or other hoist as easily as a sling, requiring no changes whatever in the lines nor in the machinery to make the rig ready for clamshell bucket work.

When the bucket work is finished, the closing line yoke is slipped off the block hook, leaving the rig free for other service.

Blaw single line buckets are also frequently reeved direct to the hoisting drum.

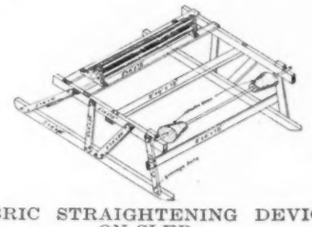
There are no locks, catches, nor other sliding parts in the Blaw single line bucket. The locking effect is obtained simply and effectivly by the position of the folding arms carrying the lower block. Dumping of the load can be accomplished either automatically (by relieving tension on hoisting line), by hoisting the bucket against a fixed stop, or by pulling on a hand line attached to a tripping lever, which line may serve also as a tag line.

Either standard carriage type or Blaw automatic single rope type cableways can be readily equipped for clamshell bucket operation by replacing the fall block with a Blaw single line bucket with tail sheave. No additional lines or changes in the hoist are needed.

These buckets are kept in stock in standard sizes of capacities of 12.75 to 43 cu. ft., water level, corresponding to 18 to 86 cu. ft., heaped, as for ashes and other loose, light materials.

Pavement and Curb Reinforcement.

National road fabric, handled by the H. H. Robertson Co., is an electrically welded wire fabric for concrete road reinforcement. It has no rough or sharp edges, the mesh varies to suit requirements and is heavily galvanized. It is furnished in flat sheet bundles or in rolls from 200 to 400 feet long. It is made in 16 standard styles with 4x8 and 4x12 mesh with wires of 7 to 11 gage, a sectional area of 0.043 per square inch and a weight of 20.0 to 34.8 per 100 square feet.



FABRIC STRAIGHTENING DEVICE ON SLED.

A set of rollers provided with a conical idler guide to keep the fabric in line is mounted on a sled and can be furnished for conveniently straightening the rolled fabric.

The National curb reinforcement consists of a light steel bar, curved in cross sections to make a fillet protecting the rounded upper corner of the curb, and anchored to the concrete by bent strips projecting into it that are sheared from each edge of the fillet, except for a short length, where they are integral with it. It is heavily galvanized after fabrication and is sold in stock lengths of 10 feet, bent if required to any radius.

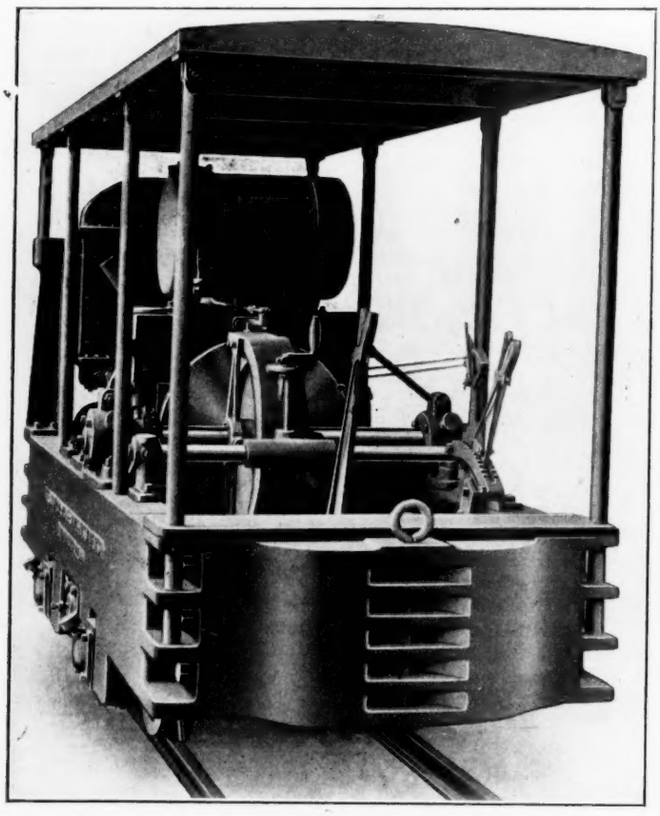
The Asphalt Association.

Brochures No. 5, 6, 7, 8, 9, 10, and 11, recently issued by this association are convenient and attractive and contain information concerning terms used in connection with asphalt for highway work, asphalt macadam, asphalt fillers, sheet asphalt, asphaltic concrete, and asphalt paving mixtures, all of which are intended to be of practical sevrice to designers, officials and contractors.

A Correction.

Some of the principal features of the Burton Gasoline Locomotive were described in Public Works, Feb. 21, page 127, where it was erroneously stated that the fuel consumption, either gasoline or kerosene, was from 5 to 10 gallons an hour, when the consumption should have been stated as at the rate of 5 gallons in 10 hours. The locomotive is operated by a Herschell Stillman motor with four 3½-inch cylinders with 5-inch stroke, drop forged crank shaft, double heat treated bearings, helical type timing gears, thermo-syphon cooling, and lubrication force feed by pumps, to crank shafts, cam shafts and pump shaft bearings and splash to upper and lower rod bearings and cylinders. It is rated at 25 h.p. for 1,000 r.p.m. and 41 h.p. for 2,000 r.p.m.

The drive wheels are operated by steel roller chains and cast steel sprockets of extra size. The locomotive is equipped with special sand boxes heated by engine exhaust and sanders operated by foot pedals providing for a start under heavy loads with adverse track conditions. The cab extends the full length of the locomotive giving comfortable room for the operator and free access to all parts. The designers have aimed at a high degree of simplicity and accessibility.



FRONT VIEW OF GASOLINE LOCOMOTIVE.

Clark Truck Tractors.

These machines although designed largely for service in factories have many uses for general construction requirements such for instance as distributing concrete from a mixing machine to the forms. They are essentially small, simple, gasoline power trucks of very rugged construction with a 25 h. p. 4-cylinder engine, internal gear drive axle with enclosed drive gears, steel wheels with roller bearings and solid rubber tires. They have a 78-inch wheel base, ground clearance of 9½ inch, over-all height of 62 inches, maximum load capacity of 2,500 pounds, weigh 2,450 pounds and have a speed of ½ mile to 12 miles per hour. When fitted with a tilting body or bucket they are very convenient for transporting wet concrete and can be used to advantage for country road paving for a distance, it is claimed, of 2 miles. These same truck tractors can bring back loads of cement and aggregate to the mixing machine. They are of simple design with rear wheel gear, low center of gravity, large ground clearance, flexibility of control and low upkeep and operating costs.

PERSONALS.

Mumm, Hanz, Jr., who has recently been county engineer of Snohomish Co., and city engineer of Everett, Washington, has joined the staff of the Portland Cement Association in 1916 and has just been put in charge of a new association office at 1406 5th St., Portland, Ore.

Evans, Kenneth, has been promoted from assistant construction engineer, Division of Highways, Illinois Department of Public Works and Buildings.

Hyde, Dorsey W., Jr., has resigned as librarian of the New York Municipal Reference Library to accept a position as chief of the Motor Truck Research Bureau of the Packard Motor Car Company, of Detroit, Mich. The bureau will be a new development of the company's service, aiming at the collection and classification of all data pertaining to transportation problems and their solution.

Rankin, Miss Rebecca B., who has served as assistant librarian during the past year, has been appointed librarian of the New York Municipal Library. Miss Rankin is a graduate of the University of Michigan and of Simmons School of Library Science, and has served previously as librarian of the Washington State Normal School and as assistant to the director of the New York Public Library.

Goldsmith, William, has resigned his position as construction engineer with the City of New York to become president and general manager of the Riverdale Construction Co., Inc., at 1440 Broadway, New York City.

Carruthers, W. S., division engineer, Division 3 California State Highway Commission has received a year's leave of absence to act as engineer of Sacramento Co., Calif. ed engineer of Jackson Co., W. Va.

Lupfer, Edward P., has been appointed member of the Buffalo Public Bridge Commission to investigate proposed international bridge across the Niagara river.

Webster, George S., has been appointed chief engineer Bureau of Surveys, Department of Public Works, Philadelphia, a position he held many years before accepting that of Director of the Department of Wharves, Docks and Ferries which he is now vacating.

Morse, E. K., opposed the street car loop project originated by E. V. Babcock, of Pittsburgh, and has been removed by the latter from his position as Transit Commissioner of Pittsburgh.